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1871. Mr. B. G. Sheridan, a police magistrate at Cardwell, told that his son had taken his evening stroll with his terrier when the dog suddenly took up a scent and followed it for about a mile. The encounter was brief and inconclusive and described by the boy with the following words:

It was lying in the long grass, and was as big as a native dog. Its face was round like that of a cat. It had a long tail and its body was striped from the ribs under the belly with yellow and black. My dog flew at it, but could not throw him. The animal ran up a leaning tree. It then got savage and ran down the tree at the dog and me. I got frightened and came home.

Australian naturalists are quite willing to concede the possibility that there is a large unknown catlike mammal (probably a marsupial) hiding in the only sketchily explored forests of the York peninsula which, after all, has roughly twice the area of England. The people living there speak of it matter-of-factly, like the Australian writer Ion Idriess:

Up here in York peninsula we have a tiger-cat that stands as high as a hefty medium-sized dog. His body is lithe and sleek and beautifully striped in black and grey. His pads are armed with lance-like claws of great tearing strength. His ears are sharp and pricked and his head is shaped like that of a tiger. My introduction to this beauty was one day when I heard a series of snarls from the long buffalo grass skirting a swamp. On peering through the grass I saw a full-grown kangaroo, backed up against a tree, the flesh of one leg torn clean from the bone. A streak of black and grey shot towards the kangaroo's throat, then seemed to twist in the air, and the kangaroo slid to earth with the entrails literally torn out. In my surprise I incautiously rustled the grass and the great cat ceased the warm feast that he had promptly started upon, stood perfectly still over his victim and for ten seconds returned me gaze for gaze. Then the skin wrinkled back from the nostrils, white fangs gleamed and a low growl issued from the throat. I went backwards and lost no time getting out of the entangling grass. The next brute I saw was dead, and beside him was my prized staghound, also dead. . . .

Frank W. Lane found another report in the Brisbane Courier (unfortunately he neglected to give the date) which seems to be quite recent, telling of two men who came across such an animal at close but in a torrential rain. Their description, however, agrees well

with those quoted-there can be little doubt that a large North Australian carnivore still awaits official discovery and detailed description.
Before proceeding to the classical continent of undiscovered animals, Africa, some marine mysteries of the Pacific Ocean might be mentioned as briefly as is consistent with stating their case. One of these stories comes from the immediate vicinity of Australia, specifically from the Timor Sea, the expanse of water between the long island of Timor to the north of Australia and the mainland. This sea, the natives claim, is inhabited by a large, ferocious man-eating shark. It is larger, they say, than the well-known man-eating shark. Of course, there are a number of sharks that grow bigger than the man-eater, but these are not man-eaters. This mysterious fish is said to differ from other sharks in one important and conspicuous point: it does not possess the typical triangular fin on its back; yet it is definitely a shark. It is said not to swim at the surface of the sea but to lie in wait on the bottom. Consequently, the natives call it the "ground-shark."
To deny the truth of this story would be to assert that every fish in the seven seas is known to science, and recent events have cautioned even the greatest skeptics (they should be called optimists, rather) not to be too dogmatic in making such statements.
A few years after the conclusion of the First World War a scientist returned from a lonely but famous island in the Pacific Ocean with a tale about an animal that had never reached the white world, not even in the form of a rumor. Professor J. Macmillan Brown had spent several years on Easter Island investigating the incompletely known history and migrations of its inhabitants. He was not, as a matter of fact, much interested in animals, but when he came across references to a creature of which he had never even heard, his curiosity was aroused. The animal's name was given as niuhi by the Easter Islanders, a word for which there is no known equivalent in English or any other civilized language. Professor Brown at first thought that the "niuhi, the only animal that inspires the Easter Islanders with terror," was some local species known to science, but soon he and the other Europeans on the island found out that it was not.
It is not a shark; the Easter Island shark (mongo) does not seem to be a man killer. It is not a whale (tacraha); for besides the large mouth that

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is one of its prominent features it has a large throat capable of swallowing a man and sharp teeth capable of lacerating him.
Questioning and cross-questioning of every Easter Islander who professed to know something about the niuhi finally resulted in the following description:
The animal is about 30 feet long and is also very broad even in the head. Its arms are at least four feet long, stretching from the shoulders or below the head; when swimming these are stretched behind the neck; but when in action they are thrust forward towards the prey, which it enfolds with them and draws towards its capacious mouth; the natives call them rape,

whilst its claws or hands they call kara. It generally swims in pairs and it has a pilot-fish which the natives call mama niuhi. My informant encountered one when out fishing in a boat. He had hooked a large kahi, or tunny, and as he drew it in he saw the monster following it with its arms outstretched; by the time it reached the surface and was near the boat it had swallowed the fish and still pushed on. They struck it vigorously on the head with the oars and at last it dived. Again, on the island itself he and some others saw a niuhi approaching; the sun was behind them and threw their shadows on the water; it snapped at the shadows and disappeared.

The veracity of a number of stories told by the natives, including one that deals with two men swallowed whole by a niuhi and soon afterward disgorged alive though not exactly sound, may reasonably be doubted. But the natives, at any rate, are convinced that the animal exists, although it is not very numerous in the vicinity of Easter Island. While Professor Brown was not quite able to form an opinion about whether to believe in the reality of the niuhi, he succeeded in finding a native picture of one, brought to civilization by the Mohican party. Although this mention of what is probably an unknown sea mammal is certainly the first as far as Easter Island is concerned, I do not think that it is quite the first report on it. In June 1890 Miss S. Lovell, then a schoolteacher living at Sandy Cape, Great Sandy Island, Queensland, Australia, reported that she had seen an unknown animal which might well have been of the same kind as the Easter Island niuhi. Miss Lovell, in describing her animal, called it a "monster turtle fish" and wrote that it let her stand for half an hour within five feet of it.

When tired of my looking at it, it put its large neck and head into the water and
swept round seaward, raising its huge dome-shaped body about five feet out of water, and put its twelve feet of fish-like tail over the dry shore.... It has either teeth or serrated jaw-bones. Native blacks call it moha-moha and say they like to eat it and that it has legs and fingers. I did not see its legs as they were in the water. What I saw of it was about 27 or 28 feet, but I think it must be 30 feet in all. Whilst its head was out

Unidentified picture from Easter Island, presumably the niuhi. The original is a painted stone, brought to England by the Mohican party

of water it kept its mouth open . . . the jaws are about 18 inches in length. The body was dome-shaped, about eight feet across and five feet high, smooth and slate-gray in color. Tail about 12 feet, the fish-part wedge-shaped and fin of chocolate-brown.

It might be added here that the Easter Islanders told Professor Brown that they had caught young niuhis which had a dark-blue smooth skin. When Miss Lovell's report was doubted, she could not only furnish the testimony of five other white people who had seen the animal in the same locality within a week's time of her own observation, but she also began to question the natives. She wrote:

The blacks who had not seen it on the day I did named it at once from my sketch and called it moha-moha and laughed and said, "Saucy fellow,

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It is eight years since it attacked the blacks' camp. It can stand upright and it put its legs on the shoulders of a powerful black, six feet high, and knocked him down. That year it invaded their camp, and nearly caught one man by the leg. For months after the blacks camped inland.

Although people in Queensland have been on the lookout for the moha-moha since that time, no additional report has ever come in. But that absence of additional evidence is not quite sufficient reason for doubting the word of a number of obviously sincere and intelligent white people who could gain nothing from such a story. And it is hard to be mistaken about the appearance and dimensions of an animal that has been viewed in bright sunshine at a distance of five feet for half an hour.

Whether the moha-moha is an unknown kind of large marine turtle or a somewhat strangely shaped marine mammal is, of course, impossible to say. But it seems to me a fairly reasonable hypothesis that the moha-moha of Queensland and the niuhi of Easter Island (which seems to be known under a similar name in the Marquesas Archipelago also) are the same. One day the animal may become definitely known, and be hailed as a great discovery and a "complete surprise to science."1

And now we come to the greatest rumor-breeding territory of all: Africa. This gigantic continent, the continent of endless deserts and even more endless tropical forests, of enormous rivers and horizon-spanning lakes, is literally alive with stories of undiscovered animals, animals ranging in size from tiny mice to a kind of river dolphin or river whale said to inhabit certain streams of the West Coast. The suspicions range in variety from unknown apes to (literally) still living dinosaurs. Of course not all of these rumors must necessarily be true, but some of them were, as has been shown by the discovery of the okapi and others. When the okapi burst as a surprise on the scien-

1 Evidence of a large and unknown animal, possibly a gigantic turtle, has turned up in Florida during the winter 1947-5. "Something" had tried to climb the sea wall, without success. The tracks looked like turtle tracks but were much too large and too far apart for anything known.

tific world just after the turn of the century, big-game hunters, zoologists, and animal dealers began to turn an attentive ear to other rumors they might be true, after all.

In particular the files of Carl Hagenbeck, animal dealer at Stellingen near Hamburg in Germany, were combed. Dubious reports of tales told by natives were often brought back from Africa by Hagenbeck's collectors. There were articles in the files about animals that could not be classified, catalogues of animals that were described as living in Africa but that did not appear in delivery bills of the animal trade.

Interest began to center upon Liberia, situated on the Atlantic coast

of the Dark Continent. Specifically, it pointed to the possible existence of an animal known only by report under the native name of nigbue. Slowly the history of this nigbve began to take form. First was found a description of the animals of the "Pepper Coast" (Liberia) written by the Dutch Dr. Dapper in 1688. In this description three varieties of wild hogs were mentioned. Two of them were comparatively abundant and well-known; the third, described as much larger than the others, black, and very dangerous because of its sharp teeth, presented a puzzle. Then someone guessed that this third "wild hog" might be the same animal described in 1844 by an American physician, Dr. Samuel G. Morton.

Dr. Morton had acquired a single skull, which, he had been told, belonged to an animal that looked like a large pig. Morton saw at once that it was by no means a pig, but an animal related to the hippopotamus. The relationship did not seem to be very close, so Morton invented a special generic name: Choeropsis. The common name unfortunately became pygmy hippo, which makes it seem as if the nigbve of the Negroes were only a dwarf form-"only" six feet long-of the common hippopotamus. Actually the two are not "brothers" but only distant cousins, as Dr. Morton had deduced from the skull.

In the eighties complete specimens of the animal-killed by native hunters were seen by the Dutchman Büttikofer and the German Schweizer. Büttikofer did not see the animal alive and for that reason the skins were mounted very faultily in several museums. For some

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The gastrophetes of Ktesibios is the earliest example of which we have documentary evidence. But the crossbow did not become important until more than a thousand years later when somebody, flexing a fine sword, thought of substituting a steel bow for the wooden one.

Dead or Alive?

ANOTHER LOOK AT ATLANTIS - and fifteen other essays by Willy Ley

1969

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DURING THE EARLY PART of the eighteenth century some very vague rumors about gigantic bones reached Paris. Unaccompanied by any evidence, these rumors traveled via Spain, for they originated from Argentina. Shorn of embroidery and conjecture, they stated that large bones could be found in the pampas. These were said to be as large as the bones of elephants.

The gentlemen of the Academy in Paris decided that it was best not to say anything. As far as anybody knew, there were no elephants in the Americas. Still, South America was not well explored yet, so-let the Spaniards prove their casc if

they have one.
It so happened that they did.
During the earlier years of the 18th century only occasional single bones had been seen by literate men, usually in places where a river cut into the soil of the pampas. In 1789 a complete skeleton was found, fortunately not too far from Buenos Aires, at a place called Lujan. The viceroy ordered that the bones be excavated and sent to Madrid. There a scientist named Garriga assembled them and, in 1796, published a first description.
The animal had been about the size of an elephant, or would have been if its legs had been a little longer. It stood eight feet tall at the shoulder and had an overall length of 14 feet.

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The first thing that impressed Garriga was the legs, but not because they were beautiful. The boncs were incredibly heavy, far more massive than the corresponding bones of an elephant. The tail was also very massive and long for a big animal (which usually have tiny tails) because it was long cnough to just touch the ground. But while the comparison with an elephant was obvious because of the size, it broke down when it came to the foot skeleton and the skull. They did not resemble anything ever seen before, at least not in such a size. The skull showed clearly that this giant was a sloth.
Now it needed a name, which was compounded from the two Greek words for "large" (megas) and "mammal" (therion) in the Latinized version of Megatherium americanum. Naturally things did not stop with this first skeleton. Pictures of it got into books, partly because it was the first and partly because it was so big.
More discoveries were made and scientists soon knew that there had been several spccics of giant sloth. The second spccics to be definitely established was Mylodon robustus, which was 11 feet long and differed from Megatherium mostly in having forelegs about as long as its hindlegs; in Megatherium the forelegs are a good deal longer than the hindlegs.
The third species was named Mylodon gracilis. Now the word gracilis would normally be translated as "dainty," but in this case the normal, or any other, translation just did not apply. The animal was by no means "dainty." It was a heavy-boned nine-foot monster.
It is possible that gracilis was used merely as the opposite of robustus. It is more likely that this name is a case of Teutonic humor, for the man who coined it was Professor Hermann Burmeister, of Germany, who had gone to South America on a trip of exploration and then decided to stay

and settle down, mostly because of Megatherium and Mylodon.

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Hermann Burmeister was fifty years old when he made this decision (in 1861 or 1862), but he still managed to enjoy thirty-one years of residence in the country he adopted for zoological reasons. When I state that he "enjoyed" these ycars, I do not use the term loosely. According to all accounts, life in Prof. Burmeister's house was friendly, witty and gay, and it was permanently open to any fellow scientist and any intelligent layman who was willing to talk Megatherium and other pampas fossils. That there could possibly ever be a shortage of domestic or imported wines never occurred to Burmeister, unless he had nightmares, which seems unlikely. Burmeister's closest scientific associate and his successor (when Burmeister died in 1892 at the age of 85) was Professor Florentino Ameghino. Up to 1892, expert descriptions of pampas fossils had been in German; from then on, they were in Spanish. But behind all the scientific gaiety and the fun and thrill of a steady stream of discoveries there was one unanswered question. How old were the boncs Burmeister and Ameghino dug up, cleaned, measured, assembled and described?

This question at that time was simply unanswerable, but Burmeister thought that while he could not name a figure, he could at least give an answer of sorts.

There was general agreement that man had originated in Asia and invaded the American double continent via the Bering Strait. This naturally meant that man had arrived in South America much later than in North America, since he had to traverse the length of the North American continent first. Any figures which were then mentioned were naturally guesses; man had probably arrived at the northern end of South America 3000 to 5000 years ago. Burmeister based his answer on this figure.

Man and Megatherium had never met, Burmeister was convinced, because the natives did not have any recollection of such animals and had invented a legend to account for the

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bones. They thought that the large animal was something like a gigantic mole which was instantly killed by sunlight if it inadvertently "broke surface."

Burmeister's ideas might have been well reasoned, but the facts were against him. Megatherium, the giant sloth, was very often associated with a giant armadillo-Glyptodon- and the two animals had obviously lived at the same time. But remains of Glyptodon and human artifacts were some-

times found together, and the prize discovery was a human skeleton sitting inside the giant carapace of a Glyptodon. This was certainly an ancient form of burial for somebody of importance. Finally, a skeleton of Megatherium was unearthed which was incomplete in a significant manner. The four legs were there and undisturbed, but most of the other bones were missing, and there had been a fire in the center, between the legs. It was perfectly apparent that here was a giant sloth that had been caught in a pit and roasted right in the trap from above.

There was no doubt then that the early South American Indians had known Megatherium "in the flesh," but it still did not answer the question: when had this happened?

In the meanwhile something else had taken place which did not seem to have a connection for a long time. By coincidence, another German who had made his home in South America figures in this section of the story, though not as prominently by far as Professor Burmeister.

Near the southern end of Patagonia there is a fjord or inlet -locally called a "canal"-with the gloomy name of Ultima Esperanza (Last Hope). There the retired German sea captain Eberhard bought himself some land and built a house. Visitors to the Eberhard ranch noticed that the hide of a large animal was hanging over some bushes. Some of these visitors or so it was told later-tried to cut a picce off that hide, which proved to be extraordinarily difficult. The reason was that a large number of bean-sized "bones" were cm-

bedded in the hide. If any one of these visitors had been a naturalist, this fact would have done more than just make him suspicious; but evidently nobody, including Captain Eberhard, had any profound knowledge of natural history.

At some time-the date is uncertain, but it was after Burmeister's death-such a piece of skin reached Ameghino. It has never been established whether this particular piece came from the Eberhard ranch; Ameghino himself did not think so. The important thing was that this piece of skin was, or looked, fresh. Not fresh like animal skin in a butcher shop, but rather like untanned hide in a saddler's establishment. In any case it certainly was not fossil and Ameghino decided that logic, however incredible, had to prevail. A piece of Mylodon skin proved that the animal still existed somewhere.

Ameghino called a press conference. Newspapers around the world carried articles which declared: "The Giant Sloth Is not Extinct." The very fact that this animal, which for so many years had been so proverbially extinct, was supposed to be still alive set thought going in various directions at once.

Was there any evidence in addition to the piece of skin? Did somebody in the past mention the giant sloth in any manner, probably with a native name which conveyed no

meaning to readers elsewhere?
And, finally, where can they be found, to be captured for a zoological garden?
Professor Ameghino said that he did have additional evidence. Besides his piece of skin from an unknown source, there was the Ultima Esperanza hide. And then there was the story told by Ramón Lista, onetime Governor of Santa Cruz-he was later killed by Indians.
Lista reported that he had been with a hunting party in the interior of Patagonia. While camping at night, he and his party had scen an unknown animal which looked somewhat like a pangolin, except that it was covered with long hair.

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The animal escaped, even though the hunters shot at it with tlicir rifles.
Since Ramón Lista was a learned man with much experience in Patagonia (he wrote several books about his land which received high praise and are said to be still worthwhile reading), a story like this deserved attention. Strangely enough, Ameghino at first disregarded it, thinking that Lista must have been somehow mistaken. But then he suddenly changed his mind. A while later he even coined the scientific name Neomylodon listai (Lista's New Mylodon) and pointed out that it was quite possible that one or more of the hunters' shots had hit, but that they did no harm because of the bony nodules in a Mylodon's hide.
Then a native legend about a Iemish was dragged into the giant sloth debate and things really became confused. The Iemish was claimed to be a large beast that lived both on land and in the water, usually hiding in the water. It was a flesh-cater and drowned horses to eat them. Or else the Iemish was a beast the size of an ox that was harmless and nocturnal. During the day it slept in burrows which it had dug with its large claws. Finally somebody supplied Ameghino with a "translation" of the word Iemish: it was supposed to mean "the one with little stones on it." Ameghino thought that all this went together beautifully and could apply only to the Neomylodon listai that he had named.
All this, however, did not go together beautifully. An animal is either a flesh-eater, in which case it can't be called harmless, or it is harmless, in which case it is not likely to be a flesh-eater. But while this could be reasoned out by logic alone, it took an enormous amount of work to establish how the confusion had taken place.
The legend of the Iemish, the one that often retreats into the water and is a flesh-eater, refers essentially to the jaguar, which is a carnivore and does swim well. It probably also

contains some confusion with the giant river otter of South America, which is of nearly the same size, is also carnivorous, like all otters, and, like all otters, lives in the water. The names which could be found in dictionaries that sound like iemish mostly are native words for "otter."

Of course the word does not translate the way Ameghino reported. It seems to be simply a name. But Ameghino, having been handed this significant-looking "translation" by somebody, made the mistake of applying the name iemish to the other legend about the ox-sized harmless nocturnal animal. (It might be added that the two legends did not exist in the same place. Their origins were 1500 or more miles apart.)

Ameghino, after having made this mistake, concluded that he had taken care of the question of available evidence. Then he set out to answer the second question; namely, whether the giant sloth might not have been mentioned by early writers on South America under another and probably native name. Here he was not only far more careful, he was also more successful.

He came across a book entitled Historia de la Conquista del Paraguay, Rio de la Plata y Tucumán by Father Pedro [AD] Lozano, S.J., published 1740-1746, in which an animal su or succarath was mentioned. It was said to be large and to have the habit of carrying its young on its back. The natives were stated to hunt it in spite of the dangers involved, for they wanted its skin to make durable cloaks.

Hardly anybody in Europe had ever heard of Father Lozano before, but when Ameghino reported on the su in professional journals, all European zoologists had an automatic reaction. They knew the su. Its picture, however fantastic, was on the title page of the enormous zoology book by the Swiss savant Konrad Gesner which every one of the Europeans had read.

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There in volume one of Gesner's Historia animalium (published in Zürich in 1955) one could find a paragraph headed De Subo ("Of the Su") which translates as follows:

The Most Obnoxious Animal that might be seen, called Su in the New Lands. There is a place in the newly found land where lives a people calling itself in its language Patagones, and since the land is not very warm they cover themselves with fur from an animal they call Su, which means Water, by reason of its dwelling mainly near water. It is very dreadful, obnoxious, as may be seen. When hunted by the hunters, it take its young upon its back, covers them with its long tail and thus flces. It is caught in pits and killed with arrows.

This had made no sense until the fight about the still-living giant sloth started; now things had changed so that Gesner's paragraph might make an exciting kind of sense.

As long as nobody had paid much attention to Gesner's paragraph as a whole, even less attention had been paid to a note which said that this description had been taken from "Andreas Theuctus." Since Gesner wrote in Latin, it was only logical that he used the Latinized form; actually this was the name of André Thévet. Thévet's paragraph on the Su is the same as Gesner's naturally, but Thévet has onc more sentence telling what happens after a su has fallen into a pit:

When it sees that it is caught, it maims and kills its young (as if maddened) and gives such terrible crics that it makes the Savages very fearful and timid. Yet in the end they kill it with arrows and then they flay it.

Incidentally, each of the learned men made a linguistic mistake, Gesner did not know that the name of the Patagonians is not derived from their own language, and Thévet was wrong in thinking that su means water. Its meaning is "covering." Ameghino came close by translating su as "cloak." Thévet is the only literary source which might be construed as referring to a giant sloth. If one wants to accept it-and Dead or Alive?

I don't see why not-one of the smaller forms of giant sloth must have been still alive in the southern part of South America during the Middle Ages.

There are two more things: Where did the hide on Captain Eberhard's ranch come from?

Well, Captain Eberhard himself located a cave some distance from his home. The cave was almost completely closed (one could just squeeze through) by a wall of boulders which was obviously piled up by people. Inside the cave, the amateur explorers found a human skeleton, two more hides, and what is generally called a kitchen midden. Later, professional investigators discovered Mylodon droppings over a foot deep, and when they went to work on these droppings, they saw that they contained ends of plant stalks which had been cut. The teeth of the animals could not have produced such a clean end.

One of the investigators, Professor Santiago Roth, then proposed to rename the animal Grypotherium domesticum, since the Indians had apparently domesticated it. This would not have been impossible by itself, but there is one major fact that speaks against the idea: domesticated animals do not become extinct! Man sees to it that they don't. If the Indians had widely domesticated the Mylodon, it would still be around with its masters. More likely the animals were just rounded up in the open and chased into the cave, where they were kept alive with forage until the time came to kill and eat them.

Before finishing up with the current scientific opinion about the whole matter, one episode, amusing in retrospect, must be told. Early in this century Sir Ray Lankester, director of the Natural History Museum in London, permitted himself to be quoted to the effect that it seemed possible that a ground sloth of the Mylodon type might still be alive in little-known parts of Patagonia.

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Chapter
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This was good enough for the owner of the London Daily Express. He decided to finance an expedition to Patagonia to search for a living Mylodon and bring it back to England, alive if possible, dead if it could not be helped.
The expedition was headed by a man named Hesketh H. Pritchard, who must have been an impatient type. Nobody knew at the time that Ameghino had blundered with respect to the Iemish, so Pritchard sct out with what he believed to be a body of facts to guide him. In South America, he quickly learned that a major mistake had been made somewhere and he grew furious. Though he had traveled thousands of miles and had only another two or three hundred miles to go to reach Captain Eberhard's ranch, he did not do so. He turned around, went back to England and wrote perhaps the most ill-tempered book ever printed. The Iemish did not exist, the legend about it was the invention of some publicity seekers, the whole thing was a pack of lics and, most important, he, Hesketh H. Pritchard, had been hoaxed.
Well, how do things stand now?
One of the newer and most useful tools of science, radio-carbon dating, does not help much here for lack of material. The first list of radio-carbon dates (Science, February 2, 1951) contained two entries about giant sloth material. They were:
No. 484 Chilean Sloth: Dung of giant sloth from Mylodon Cave, Ultima Esperanza, Chile (51° 35'S.). Not associated with human artifacts, though sloth and man found together in three caves 125 miles distant (cf. sample 485) 10,800 570; 10,864 ± 720; 10,832 ± 400 (years).
No. 485 Chilcan Bone: Burned bone of sloth, horse and guanaco, associated with human bones and artifacts. Valuable in determining time of arrival of man at tip of South America. Material found in Palliaike Cave, 125 miles cast of Mylodon. Comment: Most ancient of human samples from South America. 8639 ± 450.
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In other words, the samples that happened to be dated are pretty old and do not help us in determining how long

the giant sloth lived in South America. It would be so nice if we found a sample which at least makes it certain that Thévet's Su was a ground sloth.

Pritchard's expedition was not the last. Two others were organized. Both returned empty-handed. This, of course, is not proof that there are no living ground sloths any more; large portions of South America are still poorly known. And one can always argue that it is hard to see why a plant-eater should become extinct in green South America, where there have been no climatic changes for thousands of years. There is no answer to that argument except that no living, or freshly killed, ground sloth has yet turned up.

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bers, the zoologist R. Hesse, calculated that the completion of the work would take 270 years-provided that no new discoveries would be made during that time!

As regards predictions, let's start with the easiest place of all, the oceans. We know that there are unknown fish; they have been seen through the window of the bathysphere by William Beebe. They haven't been taken yet, but they will be.

Then, also in the oceans, there is the problem of the Great Sea Serpent which might be a mammal.

Thirdly, there seems to be a hitherto undiscovered long-necked and large marine turtle.

Taking the continents one by one, nothing specifically is rumored from North America. South America has many rumors emanating from it, but none specific enough to start theorizing. For a while, a kind of hunt was on for surviving giant sloths, but that has died down. Though South America will probably provide a number of novelties in time, there is no way of guessing what they might be. Europe can also be very nearly written off, except for a persistent rumor about a fairly large unknown lizardlike animal in the Austrian Alps.

Africa is a different story. There are rumors in quantity and they might very well be true.

One is usually referred to as "Nandi bear" (also as chimiset, nunda and mngwa-don't ask me how this should be pronounced), which probably is not a bear but a man-killing mammal, possibly feline.

The other is a river- or lake-dwelling killer of hippopotami,

referred to as the chipekwe, or mokéle-mbêmbe and, possibly, lau. What can be learned always has a few things in common -the unknown animal lives in fresh water, but can go on land. It kills hippopotami, but does not eat them. It has a long neck. And somehow the impression of a reptilian nature is conveyed.

Passing on to Asia, the main mystery and possible next dis-

covery is the yeti or "abominable snowman" whom the Sherpas describe as being the same size they are (average 5 ft. 6 in.) and covered with long-haired but very thin fur of a brownish color. It is possible that this is actually a very primitive human race. Elsewhere, primitive races have been pushed by their less primitive neighbors into environments that the less primitive peoples did not want themselves. This may well have happened in Central Asia to a primitive and somewhat peculiar-looking human type.

In Australia, there is one unknown animal that may be said to be almost known. It has been seen repeatedly in the northeast part of Australia, the Cape York Peninsula. It is rather matter-of-factly described as a "cat," as large as a strong medium-sized dog, with a head resembling that of a tiger. It is described as striped, black on gray, with sharp claws and pointed cars. One witness saw it kill a kangaroo.

The animal is obviously rare and its habitat restricted to a comparatively small arca. It could be either a real "cat" from the description, a feline carnivore like a large lynx. Or else, which would be much more interesting if it turned out to be the case, it could be a marsupial carnivore like the Tasmanian Tiger.

New Zealand, finally, could harbor two more discoveries that would not be complete novelties because they have been rumored for so long. One is the Waitoreke, the only (but undiscovered) indigenous land mammal of New Zealand. The other, rumored from the Dusky Sound area, not too far from Takahe country, is a small Moa, the type called by scientists Megalapteryx. Like the Takahe, this Megalapteryx was known to the Maori and the most recent Moa remains known are of this type. Whether there are any left is doubtful, but not impossible.

Well, that's the story. Like all stories of discovery, it has no end, properly speaking, because the end consists of opening new vistas.

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Hunting the Dodo

ONCE UPON A TIME, there lived on the island of Mauritius a bird named the dodo, with the scientific name of Didus ineptus. Come to think of it, this is not a good beginning. The story of the dodo is not a fairy tale but the truth, or as much

truth as can still be established. Moreover, this first sentence is a very unscientific oversimplification. Let's try to make it a bit more accurate. Then it will read just about like this:
From a period, the beginning of which cannot be ascertained, but which might be considered roughly equivalent to the beginning of the glacial age in higher latitudes, until about the year 1680 A.D., a large and flightless bird, classified as being the representative of a sub-order of the Columbiformes or pigeonlike birds, known to have existed on the island of Mauritius, or Zwaaneiland, also known as Ile de France, was called dodo, or dodaers, or dronte, but also dinde sauvage, Walchvogel or gekapte Zwaan (hooded swan) and several other names, with the scientific designation of either Didus ineptus or Raphus cucullatus, which are equivalent in scientific usage, but with Raphus cucullatus holding the chronological priority.
Well, now, this is more accurate.
It also complies with the order drilled into newspapermen: "Get all the facts into the first paragraph."

But I'm very much afraid it would probably be most intel-

ligible to somebody who knows these facts already and who, logically, does not have much reason to read it at all.
I had better start over again, this time with the fundamentals. To the east of Madagascar, strung out along the 20th parallel of southern latitude, there are three reasonably large islands.
Their current names are Réunion, Mauritius and Rodriguez -at least, that's the way the name of the last appears on Admiralty charts, both British and American. For some unfathomable reason, the dependency of Rodrigues, when it makes an official report to the colony of Mauritius, spells its name with an "s" at the end. I am making a point of this difference in spelling for the sole reason that it happens to be the smallest of all the difficulties and discrepancies we are going to encounter. The more serious problems will come up later.
It is hard to say just who discovered these islands. There exists at least onc old map on which the three islands have Arabic names. It is quite likely that Arab trading vessels did discover them, but without paying any special attention to their discovery, since the islands were uninhabited and it is exceedingly difficult to barter on uninhabited islands.
At any event, the Arabs did not even bother to locate the islands with any degree of care. On the map mentioned, they are drawn as forming an equilateral triangle and are placed far too close to Madagascar.
The first European discoverers were Portuguese but, strange to say, it was the second of the Portuguese discoverers who had his name attached to the islands.

The first one was Diogo Fernandes Pereira, who sailed these waters in 1507. On February 9th of that year, he found an island some 400 miles to the cast of Madagascar which he named Santa Apollonia. It must have been the present Réunion. Soon after, his ship, the Cerné, sighted the present

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Mauritius. The navigator landed and named the island after his ship, as Ilha do Cerne.

This, I might say right here, led to two different misunderstandings. Much later, around the middle of the nineteenth century, somebody who obviously did not know the name of Pereira's ship wondered why the navigator should have named the island after the island of Cerne, mentioned by Pliny the Elder. Wherever Pliny's Cerne was located, it could not be to the cast of Madagascar.

The other misunderstanding took place quite soon after Pereira's voyage. Dutch explorers who came to Mauritius and knew the old name thought that Cerne was a miswriting for cigne (swan) and that Pereira had thought the dodos to be swans. The Dutch did not bother with the zoological problem involved; they "translated" Diogo Pereira's name into Dutch as Zwaaneiland.

Pereira, who was on his way to India, found Rodrigues later in the same year. It was first named Domingo Friz, but also Diego Rodriguez. The Dutch apparently found this hard to pronounce and talked about Diego Ruy's island, which then was Frenchified into Dygarroys-but the official French name for a time was Ile Marianne.

Six years later came the second discoverer, Pedro Mascarenhas, who visited only Mauritius and Réunion. No name change was involved for Mauritius because of this rediscovery, but Santa Apollonia (Réunion) was renamed Mascarenhas or Mascaregne, and to this day the islands are called the Mascarene Islands.

The subsequent history of the islands was just about as complicated as this beginning. Réunion, the largest of the three islands, 970 square miles in extent, was officially annexed to France in 1638 by a Captain Goubert from Dieppe. I don't know why one annexation was not considered sufficient, but the historical fact is that the annexation was repeated in the name of Louis XIII in 1643 and once more in

Manu Adriani Venny Pictons/

Fig. 27. The dodo of Mauritius as sketched by Adrian van de Venne in 1626.

1649 by Etienne de Flacourt, who changed the name from Mascarenhas to Ile Bourbon. After the French Revolution,

that name had to go, of course, and Réunion was re-established. But then history can be read quite easily from the various changes, for it became Ile Bonaparte. Since 1848, it is again Réunion.
Considered non-politically, Réunion is a volcanic island with three rather tall peaks. The tallest is the Piton des

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Neiges, which measures 10,069 feet. The other high elevation is simply called Le Volcan by the inhabitants of the island, but Le Volcan has more than one peak. One, called Bory Crater, is 8,612 feet above sea level and extinct. The other crater, known as Fournaise, is only 8,294 feet tall but still active.
An island in such a location can grow tropical fruit and there are banana plantations and breadfruit trees, not to mention coconut palms. But these plants were introduced. The original vegetation included a dwarf bamboo, a variety of casuarina trees and a plant called by the trade name "red tacamahac," botanically Calophyllum spurium.
The second island, Mauritius, is somewhat smaller than Réunion (about 720 square miles) and likewise of volcanic origin. But all volcanic activity on Mauritius is a thing of the fairly distant past. The names of its three highest mountains reflect the changing ownership of the island through the centurics. The highest one, 2711 fcct, is called Black River Mountain. The second one, 2685 feet, is Mt. Pieter Botte, while the third, 2650 feet, is called Pouce.
The island is surrounded by coral reefs which a ship's captain has to know well, but it has a fine natural harbor. These two features prompted the Dutch to annex it in 1598 and they gave it its current name after Count Maurits of Nassau.
The Dutch abandoned Mauritius in 1710. For slightly more [AD] than a half a century (1715-1767), it was French and called Ile de France. In 1810, it was taken by the English, who restored the Dutch name.
Right now, Mauritius is a "spice island" where spices, pineapple, mangoes, avocados and bananas are grown, along with sugar cane. But the original vegetation is still represented by ironwood trees, ebony trees, traveler's trees and bamboo.
Of course, domesticated animals were introduced on both islands, but Mauritius is somewhat special even in that re-

spect the deer that can be found there came from Java, not from Europe.
As regards Rodriguez, its story is similar but shorter. Its extent is only 43 square miles. It is volcanic in origin, with

1300-foot Mt. Limon as its highest peak, and there is a fringing coral reef. The ownership of the island was Dutch, French and English in succession. In all cases, the first inhabitants were either deportees or people in voluntary exile, some of them mutineers, some refugees from religious intolcrance.

Though all this had to be mentioned to establish a background, none of these facts would have made any of these islands famous. The only one which would enjoy a kind of restricted fame would be Mauritius, among stamp collectors, because of an early philatelic error which produced some of the rarest stamps in existence. But these Mascarenc Islands are famous because they once were the home of the dodo and related birds.

The story of the dodo (let's concentrate on the Mauritius dodo for the time being) looks rather simple, if somewhat sad, in rough outline. Its existence was first reported by Dutch navigators, who were far less thorough in their descriptions than one would now wish they had been. But they made up for this to some extent by bringing live specimens back with them to Europe. There they were painted, mostly by Dutch painters and, again it must be said, not as well as one would now wish.

But the major blunder was committed in England. About 1637, give or take a year, a live Mauritius dodo arrived in England. It lived there for quite some time, and after its death, it was "stuffed" (badly, no doubt) and found a place in Tradescant's Muscum in London in 1656. A few decades later, the stuffed dodo was transferred to the Ashmolean Muscum at Oxford. This was in 1683-as we now know, two

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years after the last report of a live dodo on Mauritius was put on paper by one Benjamin Harry.

In 1755, the curator of the Ashmolean Museum decided that the moth-eaten old skin was a disgrace to his fine collection and ordered that it be thrown away to be burned with other trash. At the last moment, somebody wrenched off the head (partly decayed) and one foot (in good condition). They are now about the rarest items on record.

Even this outline story contains one more surprising item. The first scientist to include the dodo as an exotic bird in a book on natural history was Carolus Clusius in 1605. Later, Carolus Linnaeus gave it a scientific name, and quite naturally the dodo entered into the zoologicals works of Buffon in France and Blumenbach in Germany.

But by 1800, nobody had ever seen a dodo. The available paintings did not seem convincing. They looked like caricatures to begin with and did not even agree with each other.

Some scientists, bent on a housecleaning in scientific literature, began to doubt whether there had ever been such a bird. Maybe it was all a misunderstanding, if not worse, and the descriptions had meant the cassowary.

At any event J. S. Duncan of Oxford felt obliged, in 1828, to write a paper with the title: "A summary review of the authorities on which naturalists are justified in believing that the Dodo, Raphus cucullatus (Didus ineptus), was a bird existing in the Isle of France, or the neighbouring islands, until a recent period." Mr. Duncan can be said to have saved the dodo from secondary extinction in scientific literature.

But let's go back now to the original sources. The first man to write about the dodo was the Dutch Admiral Jacob Corncliszoon van Neck, who went to Mauritius with eight ships. Four of them returned to Holland in 1599, the other four in 1601. Admiral van Neck's narrative appeared in Dutch in 1601 and translations into English, French and Latin were

printed during the same year, a German translation one year later.

In spite of this volume of printed matter, there are still a number of question marks. The original journal, presumably written on shipboard, was enlarged for publication- we don't know whether by the admiral himself or by an editor. Morcover, one old naturalist, who did not leave Europe, gave a dodo picture which, he said, was copied from Admiral van Neck's journal. But this picture cannot be found in any known cdition of the journal.

The passage in the admiral's journal in which the dodo is first mentioned reads:

Blue parrots are very numerous there [referring to Mauritius] as well as other birds; among which are a kind, conspicuous for their size, larger than our swans, with huge heads only half covered with skin, as if clothed with a hood. These birds lack wings, in the place of which three or four blackish feathers protrude. The tail consists of a few soft incurved feathers which are ash-colored. These we used to call Walghvogels for the reason that the more and the longer they were cooked, the less soft and more insipid eating they became. Nevertheless, their belly and breast were of a pleasant flavor and easily masticated.

The Dutch word Walghvogels (also spelled Walchvogels) translates literally as "nauseating birds," but it led to one of the many mistakes that crowd the dodo's short life history.

About two hundred years later, it was asserted in German books that there had been Forest Birds, so named, on Mauritius. There probably were, and still are, forest birds on Mauritius, but the Forest Bird was only a sloppy translation, appearing in its German form of Waldvogel. Spelling in those · days was helter-skelter in any language, so somebody probably thought that "walgh" was just a poor rendering of

"Waldt," a then frequent spelling of the German word Wald, which means forest.

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Since this has raised the problem of the name of the bird, it might be just as well to clear up this additional difficulty as much as possible.

In the most recent specialized professional work on the dodo, by the Marquis Masauji Hachisuka, not less than seventy-nine different names are listed. But the confusion is not quite as large as this figure seems to indicate, for the names clearly fall into a small number of classes.

One set of them tries to be descriptive. They are mostly French, as, for example, austruche encapuchonné (hooded ostrich), cygne capuchonné (hooded swan) and dinde sauvage (wild turkey). Another set are either translations or mistranslations of Dutch names. The Dutch names themselves are either variations on the theme of walghvogels or else descriptive terms similar to the French names just mentioned. Just two words emerge as, so to speak, "exclusive" terms. One is the name dodo, with the variations dodaars and dodaerts, and the other one is dronte.

It is reasonably certain that "dodo" is a name coined by the Portuguese, as witness a letter written in 1628 by Emanuel Altham about "very strange fowles called by ye portingals Do Do."

The fact that Altham pulled the two syllables apart, thereby changing their pronunciation, is "very suspicious-making," as a French lady I know phrased it. It is so suspicious-or, rather, indicative-because old Dutch and German writings spell the name as doedoe and dudu, all of which must be pronounced "doodoo." Since it has no real meaning in any language, it can well be, as has been asserted, an imitation of the bird's call.

The Dutch variation dod-aars or dod-aers is rather clear to an English speaker, especially in view of the Dutch descriptive remarks ende heeft een rond gat ("and has a round rump," as van Neck put it) or rond van stuiten ("round of stern," as Capt. Willem van West-Zanen wrote in 1602).

However, the name dronte, which in Dutch and in German was used about equally frequently as dodo, still is not explained. The Englishman H. E. Strickland, who wrote the first book about the dodo in 1848, and it is still good, accepted the explanation that this term was coined by Danish sailors, using their verb drunte, which means "to be slow." This is not only somewhat far-fetched on the face of it, for the Dances, for a change, have not contributed anything to

the story of this bird; it is not even necessarily correct. We simply don't know whether the dodo was slow and the evidence is not very much in favor of this assumption.
The Dutch zoologist Prof. A. C. Oudemans-yes, the man who wrote the 600-page book on the Sea Serpent-has pointed out-in another book devoted to the dodo only-that there was a now obsolete Middle-Dutch verb dronten. Its meaning was "bloated" or "swollen," which sounds much more reasonable. But Prof. Oudemans could not prove that this was actually the derivation; a lot of early writings on the dodo seem to be lost.
The records are incomplete also as regards the number of birds taken away alive. If it were not for a chance mention in Peter Mundy's journal-he served with the East India Company from 1628 to 1634-we would never know that two of them were brought to India. But his statement is definite: "Dodoes, a strange kind of fowle, twice as big as a Goose, that can neither flye nor swimm, being Cloven footed; I saw two of them in Suratt [the first British settlement in India, started 1612] house that were brought from thence [Mauritius]."
There is a similar chance mention about one having been sent to Japan, but Japanese scientists have failed, in spite of much effort, to trace its fate from Japanese chronicles and books.
Going by such remarks on the one hand and, on the other hand, by sketches and paintings stated or reported to have

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been made from life, Dr. Hachisuka listed a total of twelve specimens of the Mauritius dodo as having arrived in Europe: one in Italy, two in England and nine-five males and four females-in Holland.
In other books, particularly in works which treat the paintings as paintings instead of as ornithological illustrations, larger figures are usually mentioned. This is partly due to counting sketches and paintings made from earlier paintings. Mostly, however, it is due to the fact that no distinction is made between the gray Mauritius dodo and similar birds from the other two Mascarene Islands.
But no list, whether of specimens or of paintings, can be considered final. In 1914 and 1915, a German scientist, Dr. S. Killermann, set out on a systematic dodo hunt in museums, libraries and art galleries and discovered about half a dozen pictures that had simply been overlooked before. Killermann's feat could probably be repeated by somebody today with the inclination and the necessary time and money.
As has been mentioned, the Clusius picture has been copied from a lost original of van Neck's journal. Somebody

might still find it. Similarly, it is known that an unnamed artist on board of one of the ships commanded by Admiral Wolphart Harmanszoon made several drawings from life while the ship was in Mauritius harbor in 1602. The originals are now "lost," but somebody might find them.

Likewise, one of the several oil paintings of dodos made by Roelandt Savery is listed as lost.

In short, while a dodo investigation is no longer virgin territory, it is still a fertile field with possibilities for a diligent researcher.

One of the earliest and best pictures of a Mauritius dodo drawn from life is the pen-and-ink drawing by Adrian van de Venne. It was made in 1626 and shows a male. This is what we now think of as the normal appearance of the dodo. However, it was Prof. Oudemans who first realized that the dodo

must have had two "normal appearances"-one fat stage and one gaunt stage. This assumption explains many old sketches which look like caricatures; the latter impression is considerably strengthened by the fact that a number of sketches were made while the birds were moulting.

Oudemans' idea makes it possible to arrange all these sketches in a logical sequence, pre-moulting, at the height of the moult, post-moulting, fat and gaunt. But why a bird on a tropical island, where the food supply should be more or less the same all year round, should go through a gaunt stage at regular intervals is not yet fully explained.

The Mauritius dodo became extinct between 1681, the last time it is mentioned as living, and 1693, the first time it fails to appear on a list of the animals and birds of the island made on the spot. By 1750, the people living on the island did not even know any more that there had been such a bird.

A hundred years later, there lived a man on Mauritius who was an ardent naturalist. This man, George Clark, not only knew about the dodo, but was determined to find dodo remains. They had to be somewhere on the island, for the cntire species could not possibly have become extinct without leaving traces. But where would these traces be located? At first glance, the situation did not look too promising.

"In fact," George Clark wrote, "there is no part of Mauritius where the soil is of such a nature as to render probable the accidental internment of substances thrown upon it. It may be classed under four heads: stiff clay; large masses of stone forming a chaotic surface; strata of melted lava, locally called pavés, impervious to everything; and loam, intermixed with fragments of vesicular basalt-the latter too numerous and too thickly scattered to allow anything to sink into the mass by the mere force of gravity. Besides this, the tropical rains, of which the violence is well known, sweep the surface of the earth in many places with a force sufficient to displace stones of several hundred pounds weight."

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Another Look at Atlantis

After having reached this point, Clark all of a sudden had a new idea. If these tropical rains swept everything before them, where did they sweep it? Well, there was a kind of delta formed by three rivers running into the harbor of Mahébourg. If dodo bones had been washed into one of the rivers, this was the likely place where they might have come to rest. One part of that delta was a marsh known locally as le Mare aux Songes. Mr. Clark promised himself that he would dig there, as soon as he had the time and some means to pay laborers for the actual work.

About 1863, he began to dig, finding large numbers of dodo bones at the very bottom of the marsh, to the delight of anatomists, and to the intense astonishment of aged Creoles who were standing around and were somewhat annoyed by secing something on their own island which they had not known about. As a result of George Clark's successful digging, there is no doubt about the dodo's skeleton. As a matter of fact, it was this material which helped to unravel such problems as were posed by the sketches of artists who did not know anatomy-at any rate, not bird anatomy.

And while no museum can have an authentic dodo, several museums can, at least, boast authentic dodo skeletons, like the one at the Smithsonian Institution which was put together by Norman H. Boss.

The American Museum of Natural History in New York has such a skeleton, too, but it also has something which makes casual visitors wonder whether a dried skin might have survived somewhere.

The museum has a restoration, made in the taxidermy studios of Rowland Ward in London. The feet and the head are copied from the preserved specimens. The feathers are those of other birds, correct in color and, as far as can be ascertained, correct in shape. The dodo is in the fat stage, the one we know best from pictures.

Other Islands, Other Dodos

ABOUT 130 MILES OF OPEN SEA separate the two islands of Mauritius and Réunion. This is not a long distance for birds with a reasonable power of flight and it is only logical that many birds are common to both islands and even to Madagascar. For a flightless bird, however, 130 miles of open sea might as well be 3,000 miles-it could no more cross the one than the other. Hence it is obvious that the Mauritius dodo, of which Peter Mundy said specifically that it "can neither flyc nor swimm," could not cross over to Réunion. Nor could a flightless bird of Réunion cross over to Mauritius.

Logically, then, if there also was a dodo on Réunion, it could not be expected to be the same as the dodo of Mauri-

tius. Similar, yes, but only that. Their ancestors, presumably still capable of flight when they somehow got to the Mascarene islands, were no doubt the same. But even a short separation, as geologists speak of time, would produce very noticeable differences.

Well, there was a dodo on Réunion and it did differ from the Mauritius dodo, but for more than a hundred years, naturalists did their best to overlook this difference. Yet the very first witness pointed it out. He was an Englishman by the name of J. Tatton who, in 1625, published an account of a voyage made a dozen years earlier under Captain Castleton. Reporting on Réunion, he wrote: "There is a store of Landfowl, both small and great, plentie of Doves, great Parrats, and such like; and a great fowl of the bigness of a Turkie, very fat, and so short-winged that they cannot flie, being

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white, and in a manner tame; and so are all other fowles, as having not been troubled or feared with shot."

The only other witness who saw the Réunion dodo on the island and wrote about it was the Dutch traveler Willem Ijsbrantszoon Bontekoe van Hoorn. He spent three weeks there in 1619, and not only described what is unmistakably a dodo, but even referred to it as a Dad-eersen. Unfortunately, he did not say anything about its color.

Later researchers, though, kept coming across pictures which did not jibe with the other dodo pictures. Not only was the plumage white with yellow wing feathers, but they were different in other respects, too. The feet were more slender, the tail was different and so was the bill.

Now it is true that there are sketches of the Mauritius dodo in which the bill looks different, the reason being that the moulting dodo also shed the sheath of the bill. But these white dodos seemed to have their sheath in place. The pictures are all by just two artists, Pieter Holsteyn (around 1640) and Picter Withoos (around 1685). Since it is most unlikely that a full-grown specimen would live for forty-five years in captivity, this indicates that two specimens of the white dodo reached Europe.

The older naturalists failed to draw a clear distinction and even H. E. Strickland, in his monumental work on the dodo (1848), did not do so.

The white dodo was introduced to science as a distinct species as late as 1907, when the Hon. W. Rothschild published his work Extinct Birds. (It had the subtitle: "An attempt to unite in one Volume a short Account of those Birds which have become extinct in historical Times, etc.," but the short account turned out to be in folio with no less than 45 color plates.) The scientific name proposed for it was Didus

borbonicus. In 1937, Dr. Hachisuka changed the scientific name (for various reasons that do not interest us here) to Victoriornis imperialis.

Fig. 28. Sketch of the White Dodo of Réunion, by Pieter Holsteyn, carly seventeenth century.

Probably because Réunion is more mountainous than Mauritius, the white dodo lived longer than the gray dodo. There is a report that Mahé de la Bourdonnais, when he was governor of both islands, sent one to France. There is no record from the other end-we don't know whether it got to France or not-but Mahé de la Bourdonnais was governor [AD] from 1735-1746, long after the Mauritius dodo was extinct. The Réunion dodo fails to be present for the first time in a survey made in 1801. It must have succumbed to dogs, rats and pigs during the latter half of the eighteenth century.

That there was still something else to be said about Réunion was not even suspected until recently. But this additional mystery can best be explained with a detour to the third of the Mascarene islands, Rodriguez.

As has been told in the preceding issue, the island was first reached by the Portuguese Diogo Fernandes Pereira in 1507.

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It took almost two centuries until settlers got there, and even these went to Rodriguez only as a second choice. They were French Huguenots who were supposed to go to Réunion from Holland. It was a small group of only eleven men. Their chosen leader was a man a few years past fifty at the time whose name was François Leguat. His younger brother was also in the group.

The Dutch ship, with the French Protestants aboard, left Holland on September 4, 1690, and arrived at Réunion on April 3 of the following year. What happened then is not quite clear, but it seems that it had been believed in Holland that the French had abandoned the island. When the ship's captain realized that they had not, he did not land but set course for Rodriguez, where the French stayed for about two years. Then they built a boat and sailed for Mauritius.

A weird and senseless odyssey was the result of this act. About half a year after they had landed, they were discovered by the governor who, after a few months of deliberation, banished them to a small rocky island offshore. There they were kept prisoners for three years and then shipped, still as prisoners, to Batavia. A year later, they were released and scnt back to Holland as free men, where they arrived in June, 1698.

François Leguat did not stay long, but went to England,

where he rewrote the journal he had kept all along for publication. In 1708, both Leguat's French original and an English translation appeared.
Other voyagers had said before Leguat that there were "dodos" on Rodriguez, but Leguat was the first man who had lived there for any length of time. Moreover, Leguat could draw. He provided illustrations for his book and there can be little doubt that he had made the sketches on the spot, because some of them are rather complicated maps and plans.
LE SOLITAIRE
Fig. 29. The Solitaire of Rodriguez, as pictured in François Leguat's book of 1708. Drawing probably by Leguat himself.

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"Of all the Birds in the Island," the English edition read, "the most remarkable is that which goes by the name of Solitary, tho' there are abundance of them. The Feathers of the Males are of a brown grey Colour: the Feet and Beak are like a Turkey's, but a little more crooked. They have scarce any Tail, but their Hindpart covered with Feathers is roundish, like the Crupper of a Horse; they are taller than Turkeys
. The Bone of their Wing grows greater towards the Extremity, and forms a little round Mass under the Feathers, as big as a Musket Ball. That and its Beak are the chief Defence of this Bird. 'Tis very hard to catch it in the Woods, but easie in open Places, because we run faster than they
. Some of the Males weigh forty-fivc Pounds.'
Leguat reported that the males were brown in color, the females either brown "or fair, the colour of blonde hair"; most likely the brown ones were older females. He also mentioned that the females had a "head-band, like the head-band of Widows, high upon their Beak," and that lighter feathers on their chest formed an outline like the bosom of a woman. Leguat's drawing, therefore, is that of a female, since the males lacked these characteristics.
There is no other drawing of a solitary besides Leguat's. However, just as in the case of the Mauritius dodo, remains of the solitary have been excavated on Rodriguez, so that a few nearly complete skeletons could be constructed.
Again the story has a few wrinkles which were added later. In 1761, one of the famous transits of the planet Venus across the face of the Sun was due to take place and Rodriguez happened to be in such a geographical position that a fine observation of the transit could be made from there. The man to go to Rodriguez for this purpose was Abbé Pingré. In addition to doing the astronomical job for which

he had taken the trip, Abbé Pingré reported that the solitarics were still around. He is the last man to have seen them.
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Some five years later, Pingré's colleague and compatriot Le Monnier decided that the expedition should be honored in some manner. He had discovered a number of small stars in the space between the constellations Libra, Scorpio and Draco which could be put together into a new constellation. He was going to call it Solitarius to honor Pingré, Rodriguez and the transit of Venus expedition.
But he needed a picture of the solitary, and since his compatriot Brisson had recently published an enormous book on birds, he felt sure that it would be in there. Looking through the entries, he found a solitaire listed and copied the picture onto his star map. I don't know whether Le Monnier ever learned that the picture he used was that of Turdus solitarius, the solitary thrush!
The other wrinkle is tied up with the name of Geoffroy Atkinson, a professor of Romance literature who has written several books with titles like "The Extraordinary Voyage in French Literature before 1700," "The Extraordinary Voyage in French Literature, 1700 to 1720" and so forth. Personally, I failed to be enchanted by them; they are solid work, but I had the impression that Atkinson knew literature and nothing else.
Now I learn from Hachisuka that Atkinson, in 1921, went overboard with his interest in extraordinary voyages and declared that Leguat never traveled! He could "trace" every item in Leguat's journal to its "sources." The account of the Cape of Good Hope came from this book, the sea turtles from that book, the story of his inprisonment from still another book, the building of a boat from somebody else's memoirs.
One biologist who read this began to wonder. Leguat had said things about the anatomy of the solitary which were correct, as the skeletons proved, but which could not be found in any other book.

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While the biologist was still brooding over the article, two French librarians very politely requested that Atkinson answer a few simple questions, to wit:
Oudemans.
Fig. 30. The gable stone of Veere on Walcheren, discovered by Prof.
Fig. 31. Female Réunion solitaire, picture discovered by Dr. S. Killer-

mann.

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If Leguat had never rounded the Cape of Good Hope, why do the archives of Cape Town tell about the ship, its arrival, departure and so forth, all with the same dates as given by Leguat? Then, if Leguat never saw Rodriguez, why does the earliest map of the island (other than Leguat's own) name a few places after him? Why are there official reports from Mauritius telling of the arrival, imprisonment and deportation of refugees from Rodriguez? And, finally, why is there correspondence with the fleet commander about the trip to and return from Batavia?

Well, Atkinson did accomplish one thing. Before him, nobody had doubted the authenticity of Leguat's journal. Now we are sure that it cannot be doubted.

It remains to tell the scientific name of Leguat's solitary. It is Pezophaps solitarius. The first of these two names is put together from two Greek words: pezós, which means "pedestrian," and phaps, which means "pigeon."

Some readers who know something about the dodo's story may have wondered why I did not quote some of the well-known source material about the subjcct. For example, Sir Hamon L'Estrange's account in his memoirs:

About 1638, as I walked London streets, I saw the picture of a strange fowle hong out upon a cloth and myselfe with one or two more then in company went in to see it. It was kept in a chamber, and was a great fowle somewhat bigger than the largest Turky Cock, and so legged and footed, but stouter and thicker and of a more erect shape, coloured before like the breast of a young cock fesan, and on the back of dunn or dearc colour. The keeper called it a Dodo, and in the ende of a chymney in the chamber there lay a heape of large pebble stones, whereof hee gave it many in our sight, some as big as nutmegs and the keeper told us that she eats them (conducing to digestion), and though I remember not how far the keeper was questioned therein, yet I am confident that afterwards shee cast them all again.

My reason for not bringing this up earlier is that this statement almost certainly does not refer to the dodo, even though

the keeper called the bird by that name. The coloration does not fit the gray Mauritius dodo and certainly not the white Réunion dodo. Nor does the "more erect shape" as compared to the turkey.

As Dr. Hachisuka points out emphatically, this is a description of a bird of the type of the solitary, not of the dodo type. It must have been the use of the name dodo which made earlier researchers accept Sir Hamon's account as one

of the dodo and to surmise that this was the specimen which later was in Tradescant's Museum and finally thrown away.
There have always been some descriptions of a bird from Réunion which did not quite "fit."
There was the narrative of a Frenchman named Carré who went to Réunion in 1668: "I saw a kind of bird in this place which I have not found elsewhere: it is that which the inhabitants call the Oiseau Solitaire, for, to be sure, it loves solitude and only frequents the most secluded places; one never sees two or more together; it is always alone. It is not unlike a turkey, if it did not have longer legs."
Another very similar description came from the Sieur DuBois who arrived in Réunion in 1669. He listed the birds he saw, and when he came to Solitaires, he stated: "These birds are so called because they always go alone. They are as big as a large goose and have white plumage with the tips of the wings and tail black. The tail feathers are like those of an ostrich, they have a long neck, and the beak is like that of the Woodcock, but larger; the legs and feet are like those of a turkey."
Carré's and especially DuBois' statements led Strickland to suspect that maybe Réunion had both a dodo and a solitary.
Rothschild, after weighing all the evidence, also said that there must have been two different birds on Réunion, either two kinds of dodos which were quite far apart in appearance,

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or else one dodo and one solitary resembling the Rodriguez type.
A. C. Oudemans, ten years after Rothschild, took the position that all this was a mistake. The men who reported on them probably were not too observant as regards the moulting stages of the birds. Oudemans' main argument is that nobody described both birds, so to speak, side by side. This is admittedly sad, yet it so happens that nobody did. But if you read what reports there are, you get the impression that the bird called solitaire seems to have been quite numerous, while the white dodo obviously was not. Moreover, Réunion is large enough so that the two birds could have had different habitats.
Somewhat ironically, Prof. Oudemans himself produced evidence for a solitary in addition to the one on Rodriguez. During the First World War, Prof. Oudemans, vacationing with his wife, looked at the gable stone of a house in Vccrc, on the island of Walcheren. The stone said that the bird pictured was an ostrich. It also clearly gave the date: 1561. Oudemans did not need long to see that the bird, whatever it was, was not an ostrich. But it could be a dodo. If so,

this was the earliest dodo picture on record.
The picture is reproduced here. Prof. Oudemans sent me a print in 1936 when we had correspondence mostly about the Loch Ness animal.
It must be a gaunt dodo, Oudemans felt, for it certainly could not be a Rodriguez solitary. Leguat had been very specific about its being tailless with a round feather-covered rear end. Look at the tail feathers, Oudemans wrote. Almost like those of an Afrikaansch struys (African ostrich) or like those of a dodo.
Well, the answer is that it was not a Rodriguez solitary but a Réunion solitary (now called Ornithaptera solitaria) and the tail feathers, so prominent on the old Dutch gable

stone, are just as prominent in the so-called dodo of Florence, one of the pictures discovered by Dr. S. Killermann. This picture is now taken to portray a male Réunion, while another picture, also discovered by Killermann, shows a female. Comparing this picture with the one of a Rodriguez female by Leguat, one can see how the two birds resembled each other and in what respects they differed.
There is one more picture of the same bird (not reproduced here) which is now at McGill University in Montreal. It is of Italian origin, being picture No. 29 in the so-called "Feather Book" made by Dionisio Minaggio in Milan in 1618. It consists of 156 large pictures with birds, practically all of them hunting scenes.
The interesting point is that the birds are never painted. The real beaks, feet and feathers of birds have been used. Unhappily, the picture of the Réunion solitary is "faked." That is to say that legs and beak have been painted and that the feathers used for the body are those of other birds. But it is undoubtedly the same bird as a dodo of Florence.
That attempts to ship Réunion solitaries to Europe were made is stated by Carré, who says that two of them were caught to be sent to the king (of France) but aboard ship they died of "melancholy." In a few other cases, shipment must have been successful. The 1561 stone masonry in Holland must have had a model. One male must have arrived in Italy around 1618. We do know that there was one on exhibit in London around 1638 and there is evidence that a female got to Vienna in or about 1657.
The story has a postscript called the dodo of Nazareth or, more learnedly, Didus nazarenus.
I thought the case had been nicely cleared up by Iosif Kristianovitch Hamel of the Russian Imperial Academy of Science in St. Petersburg, which published a fairly long study in its Bulletin of the Physical-Mathematical Section in 1848.

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Professor Hamel, after reading all the sources, had found a convincing piece of evidence. You remember that the Dutch called the dodos Walghvogels or "nauseating birds" because their taste was so atrocious. (One of them declared firmly that the dodo was for wonder, not for food.) The French had translated Walghvogels correctly into oiseaux de nausée. But one François Cauche, who spent two weeks on Mauritius in 1638, wrote about the dodos nous les appellions oiseaux de Nazaret.
Cauche probably did not try to taste dodo and did not see why the birds should be nauseating, so he thought that the word nausée was actually Nazaret, which sounds somewhat similar in French. And there was a place called Nazareth nearby on a nautical chart. There still is, but it is now labeled a "bank" while on earlier charts there is an island by that name. Professor Hamel thought this was a simple mistake. He may be right. But when Prof. Oudemans checked old charts systematically, he found a few in which the name of Nazareth is not placed next to an island where we know that there is no island, but near the existing, if tiny, island which on modern charts appears as Ile Tromelin.
Nobody knows much about Ile Tromelin. It cannot be of any importance because the latest edition of the Admiralty Charts states that its position may be five miles off on the map. If it were of any importance, this would surely have been ascertained by now. Maybe the mapmakers who produced the old charts seen by Oudemans simply lettered Nazareth next to it because there was supposed to be such a place and it was the only island left in the whole area, the other suspected islands having turned into banks and shoals.
But Oudemans said that Didus nazarenus cannot be dismissed completely until Ile Tromelin has been carefully investigated. Not that he expected to find live dodos of any kind; he meant subfossil remains like those found on Mauritius and on Rodriguez.
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In principle, Oudemans is naturally correct; as long as there is an uninvestigated lead left, the book should not be closed. No such investigation has taken place. But until it is and the facts prove otherwise, I prefer to accept Prof. Hamel's explanation.
AN OTHER LOOK AT ATLANTIS - and fifteen
other essays by
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The Last of the Moas

I HAVE THE FAINT FEELING that the word "moa" would be far less known than it is if it were not such a useful word for crossword-puzzle purposes. No statistics are available—as so often happens in the case of cultural items of probably undisputed value-but I would guess that a diligent researcher could turn up a different crossword puzzle for every day in the year which shows three spaces to be filled in with something defined as "extinct bird."

To the naturalist, the three letters M-O-A spell something clse again-it might as well be D.O.A. Exploring and literate men got to New Zealand too late to see the moas, just as they have been too late in quite a number of other places. To make the whole story more lamentable, exploring scamen occasionally did get to such interesting places in time.

But they did not know what to look for, from our point of view. Maybe they simply missed what we would consider interesting. In some cases, one may suspect that they mercly failed to write down what they saw. At any event, a modern naturalist, transported back to carlier but still historical times by time machine, could seize on various lost opportunities. He would have joined the Phoenician sailors, for example, who set out in 596 B.C. to round Africa at the request of Pharaoh Nekho (or Niku) and who actually succeeded in doing it during the two years that followed. We don't know whether they passed through the channel separating Mada-

gascar from the African mainland or whether they sailed "outside" of Madagascar. We do know that they made numerous landings; one of them may have been on Madagascar. If a modern naturalist had been along, he would have made sure of such a landing in order to look for the near-fabulous Aepyornis, the enormous ostrichlike extinct bird of that island.

We don't really know how it looked. Of course we can reconstruct its skeleton; in fact, we have. But we have no idea of its plumage. All we know is that it has not been extinct for very long. The Phoenicians of that trip would surely have found it; even the Crusaders might still have been in time.

A modern naturalist would also accompany the Arabs who at a reasonably early time sailed the Indian Ocean and did go as far east as Sumatra and Borneo. The modern naturalist would have talked the shipmaster into turning due south there to get to the Australian shore. Presumably he would have been in time to see the now extinct giant marsupials of Australia, colossi as large as the strongest bull. They were no longer among those present when Australia was actually discovered.

Such a naturalist might even have seen the Megalania, indubitably preferring a safe shelter if this occasion came up. The Megalania was a monitor lizard of which the following things are certain: it was enormous in size and did not become extinct until fairly recent times.

As to its size, learned opinions differ-some scientists felt that the animal might have been more than thirty feet long; others gave it only twenty feet.

The date of its extinction equally uncertain. Anthropologists have concluded from native legends (which may or may not refer to this monitor) that the Megalania was still alive less than a thousand years ago. But the remains actually found by naturalists look older than that.

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The last item in this condensed list of missed opportunities is that our naturalist should have been aboard the good ship Heemskirk when its captain, Abel Janszoon Tasman, saw high mountains rise from the sea on December 16, 1642. This date marks the discovery of New Zealand. The modern naturalist would have made Tasman land instead of just sailing on. He then would certainly have been able to show Tasman a few moas.

Like the Acpyornis of Madagascar, the moas were ostrich-like birds, many of them very large. But there were also smaller varieties. They were distributed over the three islands which comprise New Zealand, the two large ones which are now called North Island and South Island, and small Stewart Island to the south of South Island. The qualifying statement "now called" was necessary because on some old maps you can find the present Stewart Island labeled as South Island. On these maps, the present South Island logically appears under the name of Middle Island.

We know the moas mostly from their bones that have been found in all three islands. In addition to the bones, a few feathers are known and quite a large number of eggshells that could be restored. Naturally we cannot tell which eggs belonged to which bird, for comparative size is no guide. Thic still living New Zealand kiwi, though probably not a direct relative of the moas, is at least of the same general type, and it throws any guesswork into the wastepaper basket. The kiwi, a smallish bird, lays an egg which is far larger, by comparison, than that of the African ostrich. On the other hand, the eggs of the cassowary are smaller than one would expect.

Footprints are known, too, of both the larger and the smaller species. The small ones show a stride of not quite 20 inches, while the large ones show a stride of over 30 inclics. The large ones look surprisingly like some dinosaur footprints of much greater age. In the case of the footprints as well as

of the length of the stride, there is a definite correlation be-

tween size of print and length of stride and the size of the bird. For this reason, at least some of the footprints can be tentatively ascribed to a species.

The moas of the past are now subdivided into five differ-cnt genera, each with several species. It should be said at the outset that some of the species are doubtful, since they are based on only a few remains. It is quite possible that we have a few more species in our catalogues than existed in reality; it has happened with other extinct animals that male and female were classified as two different specics if they differed considerably. However, the following is the tentative list of the moas, by genera:

Dinornis. The moas belonging to this genus were the tall-cst of the lot, their heads towering more than 12 feet above the ground. Largest of the six species was Dinornis maximus. All species were rather light-boned.

Euryapteryx. The moas of this genus were squat and heavy but not very tall, their heads being five to six feet above the ground. They must have been very numerous at certain times. There are five recognized species; a sixth is uncertain.

Megalapteryx. Two species from the South Island only. These were large for birds but small for moas, being not much over three feet tall. As the name of the genus indicates (from Greek megas, meaning large, and apteryx, the scientific name of the kiwi), they might also be taken for giant kiwis.

Emeus. Three recognized species with a fourth one uncer-tain, standing about four feet tall.

Anomalapteryx. Five species, most of them very early and rather small, of about the size of the Megalapteryx moas. One of these five species grew seven feet tall; it is also the most recent of this genus.

This list of genera, comprising just short of two dozen spe-'cies, must not be misunderstood. At no time could one have found all twenty-two species alive on the islands. The best one could have expected would have been ten or eleven

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species alive simultaneously. Unfortunately, we cannot say what time that would have been. The era of the Homeric herocs-1000 B.C.-scems like a good guess.

By now, I have told what is really known about the moas; everything else is either unknown, or uncertain, or at least disputed.

Even the story of how the moas became known to science is rather complicated. The first explorer to land on New Zea-land and to talk to the Maori living there was Captain James

Cook, during his visit in November 1769. With the aid of interpreters who seem to have been of doubtful value, Captain Cook spoke to the Maori chieftain Tawaihura and asked him, among other things, about the animals occurring on the island.

Chief Tawaihura told the captain about a large and dangerous lizard-which must have been purely mythological, since no really large lizard does or did exist on New Zealand-but did not say a word about large birds. We can be rather certain now that there were no moas in the area where Tawaihura lived, even though they may still have existed elsewhere. With great fire and lack of logic, some scientists have made much of this omission, taking the negative evidence of Captain Cook's journals as positive proof that the moas became extinct at a much earlier date.

Beginning about the year 1800, people began to visit New Zealand and write books about their travels. Strangely enough, none of the first six books written on New Zealand (or about New Zealand) even mentions the moas. The first book to mention them does not use the name; it is a narrative that was published in London in 1838. Its writer was a trader by the name of Joel S. Polack and it is merely one more kink in the story that a missionary who knew Polack swore that Polack could not write.

Well, the book with Polack's name on it exists; the New York Public Library at Fifth Avenue and 42nd Street has a

copy of it and I have read it myself. I cannot imagine that a trader can pursue his business and presumably make a profit without being able to write, but it might easily be that trader Polack did not write English and that the printed book is a translation of a manuscript in another language. At any event, trader Polack relates that he was shown very large bones and adds that the animals these bones came from were alive on the South Island. But he did not make clear what made him say so. Did the Maori tell him? Or did he draw this conclusion himself?

At about the time trader Polack was there, a Reverend William Colenso began hearing stories about gigantic birds from natives, and another missionary, the Reverend William Williams, started collecting moa bones.

The first moa relic to be placed into scientific hands was a large leg bone with both ends broken off. The year was 1839 and the hands which received this bone were very competent indeed, belonging to Professor Richard Owen, of London. They also happened to be reluctant hands-Professor Owen actually took to be a soup bone at first glance. Even the simple fact that Owen received this bone has been embroidered nearly out of recognition. A story has it that "an illiterate sailor" left the bone for Owen when the professor was not at home.

Well, the man who took it there, and Owen was at home, was a sailor all right, but far from illiterate. He was the surgeon Dr. John Rule who had specifically traveled to England with the bone to sce Professor Owen. When Owen was unimpressed, Rule persuaded him to devote more time to it. Owen first "tried" the bone in the museum by holding it against the skeleton of a cow. It did not "fit." Owen tried the skeleton of a horse next. Finally, having run out of large mammals, he held it next to the leg of an ostrich skeleton. This was it! The bone matched that of the ostrich, except for size. Once Owen was convinced, nothing could hold him back.

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His colleagues, though admitting that it seemed to belong to a bird, suggested that he wait until more and undamaged boncs became available. But Owen would have none of it. He knew that this was a bird bone, having belonged to a bird of the general build of an ostrich, but bigger and more massive by far. And since the bone was not fossil, the bird could not be dead for very long.

Thus Owen prepared a scientific report. It could not be very long, but what there was of it was very positive. Morcover, Owen reasoned, a layman does not know what to look for unless a scientist tells him. So he ordered the printing of 500 extra copies of his short report, to be distributed in New Zealand among missionaries, shipping agents and settlers. The 500 copies were crated for shipment to New Zealand to scrve as a call for more evidence. But before the crate with the pamphlets had even crossed the equator, another crate arrived in London. It was full of moa bones, the bones collected by the Reverend Williams.

There was, it is reported, some ludicrous trouble with the Royal customs inspectors who found some kind of rule against the importing of bones. Fighting, so to speak, the British Museum and the Royal Society, not to mention Owen himself, the ones who lost were the customs inspectors. The final outcome of it all was a magnificent report by Professor Richard Owen.

A few years later, an interesting story came from New Zealand. Governor FitzRoy had met an old Maori chieftain by the name of Haumatangi. The year was 1844 and Haumatangi was about 85 years old. The old man told the governor proudly that he remembered seeing Captain Cook. Since the visit referred to was the one of November 1773, Haumatangi must have been about 14 at the time, so the claim sounded credible. Haumatangi added that the last moa in his province had been seen two years before Captain Cook's visit. This statement, of course, had to be taken on face value.

Another story which was circulated a little later had it that another chieftain, Kawana Paipai, said he had taken part in a moa hunt when he was a boy. The date figured out to be 1798 or 1799. Two or three other Maori, questioned around the middle of the last century about moas, declared that their grandfathers had told them about moa hunts. These dates all worked out to about 1770. It looked, therefore, as if the last moas were hunted to death around 1800.

In New Zealand itself, scientific opinions began to be sharply divided, the battle cry being, strangely enough, "the men of The Fleet" who did, or did not, find islands populated with moas. It has to be explained here that the Maori had come from islands near Tahiti in several waves of immigration. The main (and latest) wave is called The Fleet and the generally accepted date is "around 1350 A.D."

One school of thought-which became the minority party -had it that the Maori of The Fleet began to kill the moas for food and that the process of extermination was complete in Captain Cook's time. Another school of thought, however, claimed that the men of The Fleet arrived just about in time to see the last of the moas die.

It has to be said that everything written and printed about the moas in New Zealand for several decades was not written to establish facts, but to defend either the one or the other school of thought.

The ones who said the moas had died out very early had quite a number of ingenious arguments.

So-and-so-many Maori (say during the period from 1840 to 1860) did not know that moa bones had belonged to birds when they were shown them.

The word "moa" itself was used to mean "stone" or a raised small piece of land, like a flower bed.

There were only a very few proverbs and sayings in which the moas figured; they were usually figures of speech like

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"gone like the moa." These proverbs seemed to be centurics old.

As regards the statement that "my grandfather said that he hunted moas," it was pointed out that the words "grandfather" and "ancestor" are the same in the Maori language. As for old Haumatangi, he had probably just embellished on his memories of long ago hearing folk legends.

And Kawana Paipai was disposed of in two ways. One was that he also told about battles which were obviously invented. The other was that he had never made his statement about the moa hunt; the point being that there were at least three white witnesses to the statement and only one

of them repeated it later.
In the meantime, places where moas had been slaughtered and cooked were found. There could be absolutely no doubt that humans and moas had lived together at one time. The problem was to say when.
Some scientists assumed a different native population, not only pre-Fleet but pre-Maori, which must have been the moa hunters. Other scientists said that the moa-hunter period did not have to be any other culture than Maori; they had been Maori of an earlier cultural level. This idea was contradicted mostly by the Maori themselves, who refused to believe that their ancestors should ever have changed, and who imagined the sailors of The Fleet to have been precisely like their fathers and grandfathers of about 1800. This, of course, just wasn't so-the Maori, like all peoples, changed considerably through the centuries.
Actually, everybody seems to be right depending on where you look. A number of moa-hunter campsites are indubitably Maori. Some others are almost certainly not Maori-of any cultural level. There seem to have been earlier castaways who settled on New Zealand and who did not come as organized immigrants like the Maori of The Fleet.
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A fairly new scientific tool has been brought into play with some hopes of deciding the endless battle about the time of the moa hunters and, if possible, of the last of the moas. This tool is radio-carbon dating, or the C-14 method, which can tell the age of many things by their amount of carbon-14. There are just two requirements. The first is that whatever it is that must be dated must once have been alive, bone or wood or even charcoal, for non-living things do not take up carbon-14 from the atmosphere. The second is that the object must not be older than 25,000 years or thereabouts; after that time, the carbon-14 is gone and the age becomes uncertain, except that it clearly is more than 25,000 years. Another aspect of the C-14 method is, unfortunately, that the object to be dated is destroyed in the process, so that scientists are rather handicapped when it comes to valuable specimens.
One Dinornis specimen was found in a freshwater deposit with its crop reasonably intact. And the crop was still full of food (plants) which could be sacrificed for dating. The result these plants were eaten by the bird about 670 years ago or about 1300 A.D. To some, this was a surprisingly late date for Dinornis, because they had assumed that even the pre-Fleet Maori only knew the heavy Euryapteryx type.
The argument of whether the moa hunters were pre-Maori people, pre-Fleet Maori or just Maori after The Fleet must not be taken to mean that the extinction of the moas is placed squarely on the shoulders of the moa hunters, whoever they were.
Even if nobody had ever come to New Zealand prior to

Captain Cook, the moas would probably be rare birds by now. They were completely flightless, they probably bred slowly, and they were most exceptionally stupid, for the brain of a six-foot moa was the same size as that of a turkey. Many moas died in swamps, indicating they probably could not swim. On the North Island, many perished at one time because of forest fires set by volcanic eruptions. There is some

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evidence of disease among the moas. But the main reason their numbers declined seems to have been a fairly small climatic change which diminished the open plains and increased the forest and swamp areas.

The moas were obviously on the downgrade for natural reasons. The moa hunters merely helped along and may have provided the final touch in the demise of the moa. But when was that?

Nobody will commit himself.

The proof that even the tall Dinornis type was still active and alive at the time of The Fleet has been rather a blow to some of the archeologists of New Zealand. In the course of time, the party which had proclaimed a very early date for the last of the moas had succeeded in attaining the position of "the voice of science." What they said was "science" and what the others had said was either amateurish, or just the spirit of the nineteenth century, or clse a wrong conclusion due to lack of evidence that has become known since-the phrasing depended to some extent on whose opinion was being demolished.

In one point, however, even the most conservative wing of the New Zealand scientists was rather lenient. It was admitted that small moas of the Megalapteryx type may have survived until quite recent times on the South Island. Roger Duff, the Director of the Canterbury Muscum in New Zealand (and one of those "shocked" by the outcome of the carbon-14 dating), dates two Maori-made artifacts using moa skin and moa feathers as from the seventeenth and eightcenth centuries respectively. Roger Duff's dating, incidentally, is based entirely on archeological and ethnological evidence.

Zoologists seem to feel that something must be wrong, even though they can't say what or why.

The simple fact is that some of the moa remains do not look as old as the archeologists say they must be. And New

Zealand is not a place with a dry climate which tends to

preserve animal remains indefinitely.
It is interesting that the most recent story of a moa hunt came from the South Island, in fact from the southwestern end of the South Island where the Takahe-scientific name Notornis-was finally discovered alive after having been thought extinct.
That story takes up just one part of one paragraph in Vol. II of Sir Walter Lawry Buller's History of the Birds of New Zealand, published in London in 1888. The sentence reads: "Sir George Grey tells me that in 1868 he was at Preservation Inlet and saw a party of natives there who gave him a circumstantial account of the recent killing of a small Moa, describing with much spirit its capture out of a drove of six or seven.'
That's all, but it might be prudent to say that Sir George Grey had been, in succession, governor of South Australia, twice governor of New Zealand and then governor of the Cape Colony-in short, not somebody you would expect to make up tales.
It is true that there has been no report since then, at least not one that could be called definite. But there still are virtually unknown areas on the South Island. Maybe the last of the moas, even if a small type, is still somewhere around. I don't assert that this must be the case. But there is also no reason for stating categorically that the final chapter has been written.
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Garden City , New York

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invitation, to have tea with a local landowner named Li, and in Li's house he saw a black and white pelt. The animal was not a bear, however; it was what we now call the Giant Panda.* Its scientific name is Ailuropoda melanoleucus. The first part of the name really means "cat-footed" but is meant to indicate the relationship to Ailurus, the Lesser Panda. The specific name is composed of the Greek words for black and white.
The next discovery of a large, living, and up to then unknown, animal came about ten years later. The discoverer was a Russian cavalry officer of Polish descent, Nikolai Mikhailovitch Przevalski, and the animal was the Asiatic wild horse; its scientific name is Equus przevalskii. Specimens are kept in many zoological gardens and it breeds well in captivity. Quite recently (1966) it was found to be able to crossbreed with the domesticated horse.
But the discovery that really caused a stir in the scientific world was made in Africa in 1900. This was the short-necked giraffe okapi. Officially its discoverer was Sir Harry Johnston, but Johnston said that Sir Henry Stanley should receive the credit. Stanley, a year or two prior to

1890 (the year in which his book In Darkest Africa was published) had learned about an unknown animal which the Wambutti pygmies called atti. From a discussion with Stanley which took place after the animal had been scientifically described, Johnston concluded that Stanley had actually seen okapis without realizing that they were new to science. The circumstance that is considered the actual discovery was Johnston's obtaining two strips of okapi skin from Belgian officials in the Congo. The Belgians told him that the animal was called "okhapi" by the natives, that it had a "drawn-out" muzzle, and that one had been killed recently. The skin was around and if Sir Harry wanted it, he could have it. But meanwhile native soldiers had cut up the skin for belts and bandoliers, and only two strips with zebralike markings could be found. These were sent to London. Johnston thought that the animal was an unknown species of zebra and Professor E. Ray Lankaster of the British Museum agreed tentatively, naming the animal Equus (?) johnstoni. The doubt expressed by the question mark was due mainly to the repeated mention of forests in descriptions of the animal; zebras avoid forests and prefer the open plain. In June 1901 Professor Lankaster could be pleased about his doubts. A complete skin and two skulls ar-

* The name panda is said to be a contraction of the native name niyalya ponga, which is supposed to mean "bamboo eater." I don't know whether the translation is correct, but the pandas are bamboo eaters.

rived in London, showing that the animal was not a zebra. The name then became Okapia johnstoni.

In the wake of the discovery of the okapi, European naturalists and animal dealers received a fairly steady stream of reports of other still unknown animals in Central Africa. Some of these reports sounded like fantasy, others were indubitably plain mistakes, but one was persistent. It referred to a wild hog of unusual size, and while the descriptions did not always tally they all agreed on the color: black. There also was one piece of evidence for this hog-a skull from the "Pepper Coast" that had been described by the American physician Dr. Samuel G. Morton in 1844 and had been given the name Choeropsis. The reports from Africa had also mentioned a native name for the wild hog; it was nigbve. Was the nigbve the same as Morton's Choeropsis?

The question seemed to be settled in 1904 when a Captain Meinertzhagen of The King's East African Rifles obtained a perfect skull of a black hog from a native and a somewhat damaged skin of another specimen from another native. The existence of an exceptionally large black hog was now an established fact and the animal was named Hylochoerus meinertzhageni. There was only one discrepancy. Captain Meinertzhagen's black hog had been killed in the Ituri forest while the rumors of the nigbve came from the west coast of Africa, centering more or less on Liberia. Moreover, the two skulls were so different that a small child, if

animal.

shown pictures, would have seen that they did not belong to the same

Meinertzhagen's discovery had been, so to speak, a side issue. Dr. Morton's Choeropsis was something else, possibly identical with the nigbve of the African natives but possibly extinct. Carl Hagenbeck, the animal dealer who ran his own zoological garden near Hamburg, heard more and more stories that made him believe that either Choeropsis or

nigbve (if they were not the same animal) was not extinct and he finally decided to send Hans Schomburgk on a one-man expedition to Liberia. The local people in Monrovia, black and white alike, considered this a useless quest. But Schomburgk did not give up easily and on June 13, 1911 he saw a nigbve in the open. The onset of the rainy season prevented further exploration during that year, but in February 1913 Schomburgk was back on the scene. He shot a nigbve one day and captured another one alive the next day. The case was clear. Choeropsis and nigbve were the same and obviously the animal was not extinct. But it was not

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a hog either, but a fairly distant relative of the hippopotamus; it is now popularly known as the "pygmy hippo."

There were more rumors about unknown African animals but the next one that was discovered had not been rumored, mainly because it is taken for granted in its native habitat, the Congo forest.

In 1915 Dr. James P. Chapin of the American Museum of Natural History in New York had returned from Africa from an expedition mainly devoted to the okapi. Among the things he brought back were native headdresses, ornamented with bird feathers. As time went on, Dr. Chapin was able to classify all the feathers except one, which was very large. In size, shape, and coloration it did not fit any known African bird, but Chapin was understandably reluctant to announce the discovery of a new species of bird based on a single feather, with no information as to when and where it had been pulled out of a bird's carcass.

But in a Belgian museum in 1936 he found more evidence. There were two mounted birds labeled "young peacocks." They were not peacocks and, as was proved by the large spurs, they were not young. But what were they? The possibility that they might be hybrids of a peacock and some other bird was rejected by all the experts around the museum. Chapin then met people who had seen the bird in the Congo forest. He then was convinced that a relative of the Asian peacock lived in Africa and named it Afropavo congensis, the "African peacock from the Congo." In 1937 he went to the Congo to collect specimens. The natives needed only to be told that itundu were wanted; they knew the bird well because it is not especially rare.

The next discovery, scientifically more important than either okapi or Congo peacock, has some similarity with the Congo peacock story in the sense that the natives were not surprised-only the whites, and especially the white scientists. The discovery was a fish known to paleontologists and, because of the lack of fossils in the more recent geological layers, thought to have been extinct for at least 60 million years.

Its discovery was pure chance, but chance of a kind that caused confusion and a long search. In December 1938 a fishing vessel belonging to the firm of Irvin & Johnson of East London, South Africa, had come in with a large and unknown fish (that had been bright blue when alive) aboard. The manager of the company called Miss M. Courtenay-Latimer, curator of the local natural history museum, who had made friends with the trawler captains for the purpose of obtaining specimens. The fish, the

manager said, was over 4½ feet long and weighed 127 pounds and the
EPILOGUE
captain had never seen one like it before. Neither had Miss La
Nor could she find it pictured in the reference books in her museu
She wrote to Professor J. L. B. Smith of Rhodes. University in
hamstown, South Africa, who was the outstanding authority on the
of the Indian Ocean near the South African east coast, and enc
sketch. Smith did not believe his eyes. This sketch showed a coe!
fish-a sheer impossibility, since that group of fishes had been ext
sixty million years. Moreover, the fossil coelacanths were 5 inch
inches long, not 42 feet. By the time Professor Smith got to East L
the fish had been mounted because it had begun to decompose
heat of the southern hemisphere summer. But, he could see that it
coelacanth and he named it Latimeria chalumnae (the Chalumn
river near East London). Of course he wanted more specimens,
ably freshly caught specimens with all internal organs intact and in
The search lasted fourteen years-partly because the Second
War began the following year, but chiefly because of the incredibl
that the first specimen of Latimeria was a stray which had been c
far from its usual habitat. Latimeria normally lives around the C
Islands to the north of Madagascar.
Other such stories could be added to the ones told here.
For example, the story of the discovery of another fish from t
past, Neoceratodus, a lungfish, in an Australian river in 1869.
story of the flightless bird takahe, rediscovered, after having been th
extinct, near Lake Te Anau on the South Island of New Zealand.
story of Neopilina, an invertebrate which is neither a snail nor a
but apparently ancestral to both, and which was dredged, alive,
the ocean depth in 1952.
These stories all prove the same thing: zoology is not yet a
science and the days of discovery are not yet over.

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LEWIS, N. D. C.-Continued
BOOK REVIEW DIGEST 1941
This review of the past with a glimpse
of the possibilities of the future should interest
those who are primarily concerned with men-
tal hygiene and its future. It offers sound doc-
trine in addition to the historical data." I. S.
Wile, M.D.
+Survey 77:372 D 41 330w
LEWIS, WILMARTH SHELDON. Three tours

through London in the years, 1748, 1776, 1797.
135p il $2.50 Yale univ. press
914.21 London-Description.
clal life and customs
London-So-
41-21694
"The questions I have set out to answer here are these: If we could be transported to London in the years 1748, 1776, 1797, what would we find? How did the people live? What were they like? What would we see and do? What would be the feel of the place? Oddly enough, no one seems to have tried to do this for specific years; there are books on every conceivable aspect of eighteenth-century life, but they cover the entire century.' (Pref) Bibliography. Index.
"Collectors of books about London should not overlook this piquant little volume. The feature that endears this book-written for the general reader-to scholars as well is that all statements are authenticated in footnotes."
+Books p11 D 21 '41 230w
"[The] footnotes certainly take one's mind down the pleasantest avenues of scholarship. [The author] has written here three graceful essays. It is no fault of his if the tinkle of Horace Walpole's London provides no help at all in explaining the wild strength of Churchill and Morrison's London. Henry Grattan
NY Times p8 N 30 '41 650w
LEY, WILLY. Bombs and bombing. 128p il [AD] $1.25 Modern age
623.38 Aeronautics, Military. Air raids-Protective measures
41-21995
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Booklist
Booklist 38:108 D 1 '41
"Willy Ley is a competent, adept and experienced writer on the subject of bombing. For years he has studied explosives and their effects, so that today he can be rated an expert in the field. He has experimented, written technical as well as popular articles, and was

a pioneer in promoting recent flights in Germany and the United States. His past record and present status should make Bombs and Bombing required reading." P. J. Searles
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"Here is a book of facts which should be serviceable reading whether or not we are looking forward to heavy air bombardment in the near future. For in 'Bombs and Bombing." the science editor of PM offers succinct statement and explanation to dispel the vague terror which is founded on ignorance. On some points Mr. Ley is definitely encouraging; but, encouraging or not, the information he presents should conduce to calmness and sound preparation of mind." K W.
+NY Times p8 Ja 18 '42 550W
LEY, WILLY. The lungfish and the unicorn. 305p il $2.75 Modern age
591.5 Animal lore. Zoology
41-7770
"Mr. Ley has spent thirteen years collecting material for this book, that embodies in it, in condensed versions, some of [his] articles written for American magazines. He calls it 'an excursion into romantic zoology.'
. Its
Introductory chapter concerns itself with the main
stream of zoological theory and research . but the book as a whole is divided into three parts-'one dealing with so-called mythological animals, one with animals that have become extinct within the time of man's recorded observations, and one with "living fossils." "Scientific Bk Club R
Booklist 37:487 Je 15 '41
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"Mr. Ley's treatment of the [hoatzin] itself is not quite worthy of this interesting creature and is somewhat incorrect. But these and other minor slips are to be expected in a volume of such encyclopedic quality.
scattering of pen and ink drawings makes us wish for many more. No matter how
lent the descriptions, fabulous and even
living beings would gain greatly by more visual representations. An index renders the substance easily accessible. This book will remain at the head of its particular category for a long time." William Beebe

+ Books p10 My 25 '41 650w
Cleveland Open Shelf p22 D '41
Reviewed by James McGovren
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Commonweal 34:355 Ag 1 '41 300w
New Repub 104:737 My 26 41 30w
"From the unicorn to the lungfish and the okapi, this book holds more zoological oddities than can even be listed in a short review. And every one of them has a distinct and fascinating story to tell."
+NY Times p8 My 25 '41 500w
Reviewed by Clifton Fadiman
New Yorker 17:89 Ap 19 '41 200w
Pratt p20 autumn '41
"This book on the lunatic fringe of zoology is diverting and instructive." H. S.
+Sat R of Lit 23:21 Ap 26 '41 70w
"Beyond the fact of the entertainment and instruction to be found in 'The Lungfish and the Unicorn,' the physical appearance of the book is most attractive. The drawings by Professor Gustav Wolf of New York, are a particularly welcome addition to its pages."
A. H. Compton & others
+Scientific Bk Club R 12:1 My '41 800w
LEYBURN, JAMES GRAHAM. Haitian people.
342p $4 Yale univ. press
972.94 Haiti-History. Haiti-Social con-
ditions
41-27832
Social analysis of the Haitian people, which traces their gradual development from the time of French colonial life, about 1804, to the present. Some of the subjects considered are: ethnic and historical matters; religious roles of the Vodun and the Catholic church, commerce, daily life and the Creole language spoken by the natives. The author is associate professor of the science of society at Yale University. Notes, bibliography and index.
Reviewed by J. B. Parrish
of
Churchman 156:18 Ja 15 '42 200w
"Shows & sympathetic understanding Haiti's problems and a true affection for the Haitian people. . . Will interest both laymen and sociologists. Highly recommended, cept for small libraries. M. J. Messler
ex-
+ Library J 66:949 N 1 '41 90w

"It is one of the better pictures of Haitian life done in English in recent years, and helps to fill out a panoramic scene to which writers like Melville Herskovits, Rayford Logan, Price-Mars, and J. C. Dorsainvil have contributed much. ." Harold Courlander
+ Sat R of Lit 24:16 D 20 '41 700w

LEYS, WAYNE ALBERT RISSER. Ethics and social policy. 522p $4; to schools $3 Prentice-Hall
170 Ethics. Social ethics
41-12346

"This book was written for a practical purpose. It is offered as a guide to the reader or student in findin
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25May 1941 New York Times
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From The New Woodcut, (The Studio Publications, Inc.)

Excursions Into Romantic Zoology

THE LUNGFISH
AND THE
UNICORN By Willy Ley.
With drawings. 805 pp. New
York: Modern Age. $2.75.

T
HE unicorn roamed through
the magic forests of man's
fancy for hundreds of
years; and it is sad for modern
thought to see in his type of

origin nothing more romantic than the rhinoceros. How happily, then, can we welcome the delightful implications of a surgical operation performed in 1988 by a biologist of Maine University, and look again at the references of credulous ages-if no such beast was ever born as this creature of highflown legend, well, it might have been possible to make a unicorn!

But as for the "mythical" sea-serpent-that we may assume to be no myth. We may even go as far as to debate the monster's nature and decide that it is no "serpent," not even a reptile, but a mammal. And after examining the bases for these and other baffling creatures of story we can pursue a further "excursion into romantic zoology" and find wonders among vanished beasts and prehistoric survivals and even look forward to the possibility of new discoveries at our own door.

"The Lungfish and the Unicorn" is a sound and irresistibly picturesque exploration of that richly inhabited borderland where dwell creatures of fable and mysterious fact: a world of amazing range and variety, dimly known to the public at large but now seen, certainly, to be vividly alluring. What were the giants of medieval legend whose bones men thought they had found? Elephants-yes, but why should an elephant's skull seem to be proof of the existence of the one-eyed Cyclops? The Basilisk of Viennese story a myth? Certainly but what natural foundation was there for the unpleasant attributes of that misbegotten monster? Why did dragons live in caves? And-let us step boldly into the present-could there be

dinosaurs in Africa?
For from legend the young zoologist who is our guide takes us to look at animals now extinct, like the dodo and the great auk (yes, but the auroch might be,
11
so to speak, re-created) con siders the recurrent tales of queer unknown creatures in such well-known habitats as Switzerland and the United States, and then brings his "excursion"" to survey the enigma of "living fossils, pecially in Australia and Africa. In the horseshoe crab we have a "living fossil" within sight of the towers of Manhattan, Mr. Ley reminds us. But for wonders and discussion alike we may press on to consider the lungfish and the platypus. There is pila reason for the existence of such timeless survivals in Australia, and the romantic character of that reason should satisfy any searcher for stranger-than-fiction truth. But the same reason ap-plies to Africa, "which still har-bors more zoological riddles than any other continent," and may yet produce another big surprise. From the unicorn to the lung-fish and the okapi, this book holds more zoological oddities than can even be listed in a short review And every one of them has a dis-tinct and fascinating story to tell.
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15 Oct 1952 page 14, cal 3, 4,
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volved now, while we are fighting in Korea. The lives of everyone would be involved if that conflict were to grow into world ewar
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Experts on rocket ships and the tion of the moon.
talk like this: "No government conditions to be encountered in suggested in the statement that Kaiser Steel
Those are the facts. You know can tell me what to think. No venturing beyond the earth's technicians aboard such a space Kendall Company
had reason to suppose that the do, unless it can prove that the gaseous envelope, meeting at station, using specially designed Landers Frary and Clark
common good is served by such Hayden Planetarium here, have powerful telescopes, radarscopes, Instead, he has been asking interference." This is the Amer- agreed that "space travel is and cameras, "can keep every

people to vote for men who ican way of living.
But government, keeping its
have protested, and opposed and
hamstrung our
general knew them.
possible now."
This is the second
symposium
Long Beil Lumber
Ludlow
Marlin Rockwell
ocean, country, and city under Moxie Company
National Shirt Shops
constant inspection.
Nashawena Mills
"Development of the space Naumkeag Steam Cotton
Newmarket Manufacturing
foreign policy hand most carefully away from of its kind to be held at 81st station is as inevitable as the
New England Lime
measures, men who have tried that forbidden field, may and, Street and Central Park West arrival of
dawn each day," he Nicholson File Company
U.S. Army Seeks Stockpile
To Support Atomic Artillery
By the Associated Press
In demonstration, the
where
almost 10,000
persons
have registered for the first air said. "Man has poked his nose
voyage around the moon.
into space already with rocket
missiles and is not likely to pull
it back."
Robert R. Coles, Planetarium
chairman, has not announced
The superiority of liquid fuels
how the initial crew and passen-
over solid was discussed-sup-
gers will be chosen from among plying separate tanks for fuel
those signed up. But in discus- and oxidizer, tossing overboard
sing the role of the Planetarium the whole ancient pyrotechnical
in space travel, he stressed the art of rocket making as inherited
Secretary of the Army Frank despite its 85-ton total weight, Its need for educating the public on from the
Chinese.
what is possible, rather than on
what seems to be impossible in
travel beyond the influence of
gravity.
Aberdeen Proving Ground,
Maryland
Pace, in an unveiling ceremony
for the first atomic artillery gun,

said the Army is seeking to have
a "proper share" of nuclear ma-
terials earmarked for its use.
gun
shows a high degree of mobility.
two tractor-power cabs, at front
and rear of the rifle which is al-
most 40 feet long, can take the
gun along a nighway at a speed
Willy Ley, author of books on
of about 35 miles an hour, then
roll off the road and start cross-rockets, missiles, and the conquest
of space-one of the founders of
country.
the German Rocket Society
Mr. Pace set forth the Army's
The Army never has been en-
claim to allotment of fissionable tirely happy over the fact that
material in an address prepared tactical aircraft for dropping
for delivery at a demonstration bombs, atomic and otherwise, is
of the 280-millimeter, all-pur-controlled by the air force and is
pose gun and three of the latest- subject to limitations imposed by
model tanks. The Army secretary weather and visibility. Obviously
with this in view, Mr. Pace as
serted that:
said:
use."
ditions.
Tactles Reappraisal Stressed
on can prove to be one of the
"In my view, this atomic weap-
also for use of nuclear fission field."
ahells.
asserts that man's attack on the
third dimension will come about
first through construction of a
doughnut-shaped way-station in
space. Living conditions there
will be cramped and complicated,
he says, very much like life in a
modern submarine.
Meteorite Bumpers
Motors, pumps, valves, tubing,
oxygen for crew members, meteo-
rile bumpers for protection from
stellar artillery, condensed foods,
and the problem of getting up
sufficient initial speed to carry
rockets out to the necessary dis-
tance were also considered. Prob-
lems of navigation were taken
up by Mr. Coles and others.

on
37
Phoenix 3
164 Prov-Wash 140a)
Rein Cor NY (30)
Security (1.80)
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Springfield 12
Bid Accid 1 Coy
a Also extra or extras
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Declared or pa
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34 paid after stock dividend or
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American Business Share
Axe Houghton Fund
Baystate Corp
Bullock Fund
Broad Street Investing
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Chemical Fund
Christiana Securities Co 88
Concord Fund
Consolidated Investment Tr
Diversited Tr E
Eaton & Howard Bal Fd
Fidelity Fund Inc
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Peerless (70)
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Collyer Insulated Wire Co
4) a
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Draper Corp
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Travelers 12
Durer Plastite & Chemical
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Exolon Co.
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Fruit of the Loom
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Giddings & Lewis Mach. Tool 13x
Uston & Knight Co
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Photon Inc.
Parker Appliance
Plymouth Cordage Company
Portsmouth Strel
Quincy Mict. Cold &tor & W
Recce Corp
Reed Frentice
Remington Arms Co Inc.
Rey Stoker
Rockwell Manufacturing
Scamore Manufac
Scott & Williams
Manufacturing Co.
Seaboard Finance pf
Simplex Paper Corp
Southern Adv. Bag-Paper
Sprague Elec.
Tampax Inc

Texas Gas Transmission Corp
Thompson si ndustries pl
Tracerlab
Timely Clothes
Transcontinen Gas Pipe Line
UB Envelope Company
US Envelope Co 7 pf
Verney Corp
Wamautta Mills Ine
Warner & Swasey Co.
warren Bros
West Point Manufacturing
West Virginia Prod
Weyerbeuser Timber
Whitin Machine Works
West Virginia Water Service
William Whitman
"Ex-dividend, Not qualified for aale in
Massachusetts.
Bank Stocks
a perfect BLANTS (8F) 1.60
Dr. Fred L. Whipple, Harvard
astronomer, said that studying
astronomy from the proposed
space station would doubtless
present exceedingly strange as-
pects of familiar orbs.
Self-Contained Station
At present, the earth's at-
Such an outpost in the sky will
mosphere, even
have to be a self-contained com- night, will blanket out many de-
munity "with all man's needs tails of the surface of the moon,
from air-conditioning to artificial the planets, and distant star
gravity" supplied from the earth, groups. It causes the light from
stars to twinkle continuously,
he said.
cut out the extremely significant
coordinator,
Mr. Ley pointed out that plans far-ultra-violet light and much
for such a space station are al-X and gamma radiation as well.
ready in the blueprint stage, that
Others on Program
the project is "not for the fu-
Astronomy from a station 1,075
ture, but for the present Work
miles out will end the present
on it could start tomorrow."
Dr. Wernher von Braun, tech-blindness of astronomy, he stated,
nical director of the United States perhaps make visible stars that
Army Ordnance guided-missile hardly show even
on special

As
symposium
Bk of NY 14
Bankers Tr 2
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Empire Tr 30
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48
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Insurance Stocks
"The Army believes strongly
in the concept and doctrine un- "This artillery piece opens up
derlying the application of atomic new vistas in the capabilities of
energy to the battlefield. We our army to discharge its pri-
have, therefore, exerted strong mary responsibilities in the field
efforts to insure that a proper of land combat. It provides our
share of our national stockpile ground commanders with fire
of fissionable materials is fabri- support of great range, flexibil-
cated and earmarked for such ity, and volume, which can be
delivered with extreme accuracy
and reliability at any time of the
Design Changed
The phrasing used by Mr. Pace day or night regardless of zero
left open the question of whether ceilings, storm, hail, or other con-
the Army actually has any atomic
ammunition to use in the big
mobile weapon. Blueprints drawn
in 1944 envisioned it as a general
purpose gun for firing conven-
tional projectiles, but the design vital factors in helping to force development group, a codesigner
photographic plates. "The Milky United States 14
was changed in 1949 to provide decisive results on the battle- of the German V-2 rocket, was Way itself
might be markedly
introduced as the author of such changed-I wish I knew just
At another point Mr. Pace em- blueprints. Much of his talk on how."
Also on the program were
Mr. Pace's remark about ex-phasized the atomic gun must not the early steps in the realiza-
utimate tion of the space station" was Milton W. Rosen, director, the
concerned with very practical Viking racket project, Naval
erling strong efforts to get allo- be considered the
"Let me make it perfectly problems having to do with the Research Laboratory, upholding
cation of material to the Army weapon.
also suggested that the Atomic
building, three-stage "A Down-to-Earth View of Space
Energy Commission had to be clear," he said, "that I do not job
believe that this weapon is final rocket ships capable of carrying Flight: Dr. Fritz Haber, astro-
persuaded.
Details of the new gun became or that it is, in and of itself, com- men and materials out to
mile-physicist, University of Califor- Am Surety (31
at Los Angeles, "Human Bank&Ship (260)
There an initial velocity would Flight at the Limits of the At-Boston (2.60)
pelling. With the completion of post 1075.
Comden Fire (1)
this Army atomic weapon, there
neuver and fire in demonstra- is more need than ever for a con- keep everything flying round the
mosphere," and George O. Smith, Col Nat Life (160)
dis-
Radio Corporation,

veiling ere. Invited to
veiling ceremony were members of the concepts, doctrines, and would always remain the same, cuss
of Congress and officials of the techniques of ground warfare. according to Agures of the rocket
cussing "Radio Communication Employ Or (180)
Across Space-Ship-to-Ship and
As Dr. von Braun told the Ship-to-Planet."
Realizing fully that the ultimate scientists.
decisions of war relate to battle |
The symposium held a year Den Reinsar (1.00b)
on the ground, the Army accepts first symposium held here a year
the responsibility for gaining ago, it may be only a matter of ago has just been printed in beok
mich decisions at minimum cost, 10 or 15 years before this planet form by the Viking Press, edited
Globe Rep
The 280-millimeter gun (a cal- primarily in human lives and has a new companion in the by Cornelius
Ryan, with illus-os Am Ina (1.3041
20 surely in other national re- skies, a man-made satellite, his trations in color by Chesley Hanover
11.001
Bonestell, Rolf Klep, and Fred td at Bir (100)
Arst foothold in space
Freeman.
With nature providing the mo-
The Army so far has not
an actual can
"four times more accurate at long atomic shell from the new gun. (be maintained between,
known recently when reporters
and photographers saw it ma-
several companies that collab-
orated in development and man-
ufacture of the gun.
Speed and Mobility
ber slightly more than
inches) can fire at targets 20 sources."
miles away with what the Army
claims is pin-point precision
of
nia
Aetna Cas (21)
Aetna Ins (2)
Aetna Life (a
Agricultural
AmAlliance (120)
Am Auto (2)
Am Fid & Css (1)
Am Equit (116)
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Ca (2)
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Glens Falls (3)
& (
Hartf'd Fire (32
Fund Investors Inc
General Capital
General Investors Trust
Group Securities Inc.
Automobile Shares
Low Priced Shares
Railroad Bonds
Raliroad Equip Shares
Steel
Hudson Fund
Incorporated Investors
Inality Shrs Bank Group
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1 Keystone Custodian Funds
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Knickerbocker Pund
Lexington Tr Fund
Loomis Sayles Mut Fd
Manhattan Bond Fund
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Mass Life Fund
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Bond
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Ind Stock
Low Pr Stock
National Investors Corp
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Automoblie
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Railroad
Railroad q
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Northeast Investors Trust
Putnam Pund
Railway & Light Bee
Repub Invest Fund
Scudder Stevens & Clark
Bhareholders Trust

State Street Invest
Television Fund
Wellington
Whitehall Fund
Ex-dividend, Bales prices
Bid Asked Net Asset Value
92
28
57
50
23% 97%
83
34 38
47% 4014
30
30
17% 19%
30% 27%
35% 374
Dow-Jones Ave
501, 83% 30 Inds
55% 59%
By the United Pre
October 14, 193
Open High Low
210.00 271.50 288.45
101.10 101.82 108.60
100.00 100.04 10454
Cinsing Average
60% 72%
23
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20 Rails
15 Uta
3 Stecks
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47%
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Today's Sales
Today's sales (est.)
18 volume to cle

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WOOSH! - And
Heads for its Town

[PAGE BREAK]

can fliers after their arrival in Hong-
kong. Col. Arnold is standing at left.
(Story on Page 1.)
1 America's Satellite
Tour of Outer Space
Moon
238.857 mile
Earth's
"blanket
of
atmosphere
h every 90 minutes
International News
roposed unmanned satellite about 300
of the moon.
L
(First of a series)
By Willy Ley
ATE in 1956, or early in 1957, representatives of Congress, generals, air generals and admirals, delegates of important scientific institutions and possibly members of the Diplomatic Corps will stand under a blue morning sky and gaze at a fall rocket.
The rocket will still be shrouded in the mechanical scaffolding of a Gan-
Iry crane Technicians will still be checking electrical connections, scien-
lists will be going over instrument calibrations and engineers will be looking once more at trajectory cal-
culations which, by that time, they can recite in their sleep.
Airplanes will roar overhead to warn off all shipping for 200 miles to the cast along the line of the calcu-
About the Author
WILLY LEY, the author, has long been considered one of the world's foremost experts on rockets and the possibilities of space travel. A native of Germany, he helped organize and headed up the German Rocket Society, and

achieved world acclaim as a physi
cal scientist. With the Nazi rise
to power in 1935, Ley came to
this country, where his knowl-
edge brought him even greater
fame and prestige. As an Ameri.
can, he helped greatly in the
popularization of rocketry.
tions.
Willy Ley (left), author of the accompanying article. discusses the forthcoming launching of a
man-made satellite with Dr. Wernher von Braun, famed rocket expert.
a second. By the time the sound mentum has been eaten up by gravity say: "Adaptation Maneuver accom-
reaches the visitors the rocket already and air resistance left at such heights plished" This means that
200 miles
Another minute and 15 seconds out in space, and half-way around the
later, at a height of around 45 miles, earth, the third rocket has produced a
has lifted.
final burst of speed.
there is another separation.
I
T CLIMBS slowly like an elevator
at first, but at the end of every
second it moves about 50 feet a sec-
Now the "third stage" the still
The reason is this: The artificial
smaller rocket in the nose of the see- satellite, which is the "payload" in the
and faster than at the beginning of and rocket, breaks free. The first nose of the third rocket, is supposed
rocket built up to a speed of 1'2 miles to take up a closed circular path
After 20 seconds there isn't really a second-rocket engineers do not around the earth. This circle should that second.
tors will be packed into cars and much to see any more except for a like to speak in "miles per hour." the be concentric with the circle formed
lated flight path. Soon after the visi-
buses. The fuching operation is due to bright dot in the sky but the loud- figures become too unwieldy-and the by the surface of the earth under-
start and heavy tanker trucks are speakers will keep everyone in- second rocket added the same neath, or rather inside it. Without the
adaptation maneuver the path of the
inching up to the pipeline connec- formed. One minute after take-off the
When the third rocket takes over satellite would be closed and might be
amount.
rocket is at 120,000 feet and the bulk
The visitors will be taken half a of the atmosphere is below. The rock it is already moving at three miles a more or less circular, but it would not
mile from the take-off site. This is not et is no longer climbing vertically, second before it has ever burned a be concentric with the "periphery" of
only the distance considered safe in but slantwise in an easterly direction. single drop of its own fuel. As the the earth.
case of accident, but also the distance This is important for reasons of fuel third rocket climbs slantwise through

economy because that's the way the the outer layers of the atmosphere each other all right but in a lopsided
the first rocket is just about to fall manner. Because of that, part of the
One minute and 15 seconds after back to the ground, the second is, of satellite's path would lead through the
from which events can be seen best.
Twenty minutes before X-hour, the earth turns.
traditional red flare which proclaims takeoff comes a crucial moment: "the course, still climbing, though on mo- upper atmosphere and air resistance
moment of take-off, there will be the
would gradually reduce its speed. And
"X-minus 20" Twenty minutes to go separation." The big rocket is nearly mentum only.
with reduced speed it would crash
-they are, at any big rocket shot, the out of fuel and it is time for the
smaller rocket carried in the nose of
Suddenly the loud-speakers begin the first to break free and take over.
"Separation accomplished,"
longest 20 minutes.
to call out the count-down. At the mo-
ment of "Zero-Rocket Away" the loud-speakers report.
TOT QUITE four minutes after
N initial take-off the third rocket
The two circles would be inside
soon.
It will take only 45 minutes from
the stops burning and continues like a the word "zero" for the great experi
projectile About one minute after ment to be completed in its first
visitors will see a flame below the Now the second smaller rocket that No. 1 splashes into the ocean, phase No. 2 begins Finding out what
rocket and what looks like a puff of forges ahead under its own power, 200 miles from the take-off site.
Ten the satellite does and what happens
minutes later the loud-speakers an- to it.
climbing at a slant.
But the bigger first rocket still fol- nounce that No. 2 has hit the water,
exhaust blast, roaring out of the ex- lows. It is no longer under power, but 900 miles from the take-off site. And
haust nozzle at better than 7,000 feet it takes a few minutes until its mo- after three-quarters of an hour they the Earth.
smoke.
It is actually dust kicked up by the
Saturday: A Package Falls Around

[PAGE BREAK]

GAugust 1955 Washington Pat, vach, P. C. page 21

[PAGE BREAK]

defendant Mr farskn comes to
trial before than Iris Capt kart
Schou May FE Nobleman.
Ashela and St.

Spaidler, Noble
all Lovers
comp's legal team.
tapt. James II
Jebu Laly
man and Lill
members of the
In addition to training in military
government, the group is co-ed
in maneuvers involving firearms and
grenades. The reservists will return
to Washington apa homes Arg. 13
id Fuel Rocket
lite into Space
Ketones the fific of satellite topic
A
1000
Even before America's unmanned satellite is launched
scientists are plotting the light of manned "imoons."
This one was sketched on proposals outlined by Maj.
Alexander P. de Seversky, famous aviation pioneer.
fuel rocket in its pose. One of the points of the paper was
that all the various types of rockets needed already exist.
So does the balloon
It is, of course.
most practical for various teclinical reasons
possible that the second stage may run on a different liquid
fuel than the first stage fas was the case in Project Bumper)
but this is comparatively unimportant
The important point is that a lateral velocity of four and
a half miles per second is reached above the atmosphere.
And the curious fact is that with a single rocket shot we'll
probably get two artifical satellites.
Why ?
The lower
ETS RECONSTRUCT again what must happen Here is
the top rocket of the whole assembl
L
stages have been shed during the climb through the lower
Another plex advanced in have a fairly small as atmosphere the rate phers and the top layer, the mo
sphere. The top stage is in space and has settled in its
sembly of ligand fuel racks carried alot! a large jet
In its noe is the elite proper,
The na vas to leave a much air re-orbit around the earth
lance as poule below and the jet honther alza would
the package of scientific instruments
supply some of the needed speed Mercer the jet hamb
es pot could this plane in the proper direction when
anting the rocket
Ofthand, however, the method of having a large three-
dace rocket taking off directly from the round seems the
To work to their fullest capacity they must be free of

the rocket. Mechanically this is rather simple, it only needs
a slight push. One way of doing it would be to mount the
instrument package on a tensed
spring
A release mechan-
A space package foregroundi hurtles around the earth
at 18.000 miles an hour, carrying instruments that send
data back to scientists. In background is third-stage
rocket which imparted final push to space package.
Ism is coupled with a timing device that starts running at
take off
Filty minutes after take-off the release clicks and the
spring pushes the satellite" out of the rocket
Or else it
could be done with a pull of compressed air, or even a tiny
powder chuge. The engineer will pick whichever weighs
But the top stage of the rocket ambly is in space
too and has little reason to tell hack as has the satellite
leal
The inevitable result is that there will be two bedies cir
cling the earth some distance apart
But if this release should fail to work or the instruments
The answer 13
do not function for some trivial reason
that the experiment would be worth the expense and the
effort even then.
Sunday: Which Way Around the Earth"

[PAGE BREAK]

defendant c
Schmeid!
Capt. James II
max and Falls
Nabidem.
members of the group legal fram
In addition to training to military
gus crument, the
tromp is engel
in maneuvers involving firearms and
grenades. The reservists will return
In Washington area homes Aug. 1
Three-Stage Liquid Fuel Rocket
Will Propel Satellite into Space
WHAT I DESCRIBED sterday, the takeoff of the rocket watches the stifical stellte a spares
was wattes under the asstemption foot the
Thus mesas a rocket which a maller anket in its noe and the docket rat test and Jur
smaller roket The third rock. the only partion of the whole asumbo reach space mills carries the pack
age of rarents uch is the artial satellite
But there are several
winch a plaze of instruments could be tossed into space Petone discussing
them something must be sad about gravit

all dont on what ca
In bite o mor Jam 200 years of hand sing by selcalists and pately
ly is But thought we do not too s store we do toray booth and
purpose ray the foresting of echipes to shooting thing into pac
amuse tell on a her ht of 300
works ke the
miles at would me the commit with an impact velocits of
about one mile a second in reality tud he slowed down
by air redance, but that is another story) Con els a
rocket which mea ind of a mile a second would se
coud can
real
to about 100 miles Man rockets have drave His
The faster a teket Viking has climbed to 14 S
by producan spend which is the impact velo ty for a fall
from that he h
And in Proged
male un ca
Bumper which a waste pocket.
2 as their and AC Corporal rocket
as the recond age, the WAC Corporal reached a maximuan
speed of about 1 males a second It Imbed to 250 miles
FA BOCKET or a rocket assembly could reach a velocit
of 5 mules a second it would chmb to more than 1000
miles in a vertical shot
Wish 7 miles a second it would not come back. For that
is the high velocity the earth's gravity could produce.
Compare the earthasity to a rubber hand. The harder
the pull by the rocket the farther stretches At 7 miles
a second it on top to stay in
spice All the rocket fall back utuantel because they
are fired vertically or very nearly ni fired at a slant you
get a different c.fest
It is like swing a stone around on a rubber band The
band stretched, but not to the breaking point on the
other hand, it is stretched enough that it cannot pull the
stone back. All a can do is to prevent from going farther
away.
The effect is that the stone-or rather the package of
scientific instruments which is the satellite-literally falls
around the earth and will continue doing so for eternity
unless something stops it or reduces its speed so that earth's
gravity gets the upper hand This nice balance takes place
when the rocket moves with a lateral speed of about 4'2
miles a second.
ment
TO AMOUNT of inzenuity can change this speed require
N
But it can be accomplished in various ways
One team of engmoors presented a paper at a scientific
meeting last year in which launching from a balloon was
advocated

The balloon was to carry the rocker a tembly to about
60.000 feet which would leave most of the troublesome air
resistance belong
Then a set of four very heavy solid fuel
smoseless powders booster rockets was to go into action.
They would liquid fuel rocket with a smaller liquid
Even before America's unmanned satellite is launched
scientists are plotting the light of manned "moons."
This one was sketched ou proposals outlined by Maj.
Alexander P. de Seversky, famous aviation pioneer.
fuel rocket in its nose. One of the points of the paper was
that all the various types of rockets needed already exist.
So does the balloon.
bomber
Another pict advanced was to have a furls small as
sembly of liquid tu rockels cattled aloft by large jet
The reason aan was to leave as much air re
sistance as possible below and the jet bomber also would
supply some of the needed speed Moreover, the jet bomb.
er pilot could fly his plane in the proper direction when
anning the rocket.
Offhand, however, the method of having a large three.
stage rocket taking off directly from the ground seems the
most practical for various technical reasons It is of course
possible that the second stage may run on a different liqui
fuel than the first stage (as was the case in Project Bumper
but this is comparatively unimportant
The important point is that a lateral velocity of four an
a half miles per second is reached above the atmosphere
And the curious fact is that with a single rocket shot we'l
probably get two artifical satellites.
Why:
ET'S RECONSTRUCT again what must happen. Here=
the top rocket of the whole assembly. The flowe
stages have been shed during the climb through the lowe
atmosphere, the stratosphere and the top layer, the jou
sphere. The top stage is in space and has settled in
orbit around the earth In its nose is the satellite propes
The package of scientific instruments.
To work to their fullest capacity they must be free
the rocket. Mechanically this is rather simple, it only nee
a slight push. One way of doing it would he to mount-t
A release mecha
instrument package on a tensed spring.

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THE WASHINGTON POST and TIMES HERALD
'A 20
Sunday, August 7, 1955
Red Sees Life Like Man's New Fa
Satellite to 'Report' to Earth On Outer Galaxy Planets

By Willy Ley

There are three conditions any artificial satellite must ful fill, no matter of what shape, size or design.

The first ts that it must move at the rate of about 4 miles a second.

The second is that it must move above atmosphere, else it will inse speed and eventually enter denser layers of the at- mosphere where it will burn up like a shooting star.

The third is that it must fol- low a so-calle 1 Great Circle

The term Great Circle course is fairly familiar now because airliners use it whenever feas ible. but the precise meaning of it still escapes most people. Actually it is quite easy to ex- If you slice up a hall plain of clay each shoe will form a circle but the largest circle will be formed by the slice which goes through the center of the ball It makes no difference whether you slice vertically. horizontally or at any angle in between the slice through the center will always produce the largest circle and any portion of this will be a Great Circle.

A large number of Great Cir- cles are marked on any globe. Any meridian is a Great Circle So is the equator But many other Great Citeles are possi ble. The artificial satellite must follow one of them. Which should it be?

Instrument Within

To find out let's examine the fob n the artificial satellite In external shape it may be a sphere or it may simply be the nose cone of the rocket array of instruments

The artificial satellite will circle the earth every 90 minutes. But for how long is a mat.

ter of conjecture. It could stay up there for
450 hours, or 4500 hours or 9000 hours. Its
rate of slowing down to the point where it
know,
falls to earth is of great importance. This
drawing shows the final plunge to the dense
layer of air where even reduced speed will
cause the satellite to burn up before it
reaches earth.
By Verner Forchhammer
Samuel
the Fairfa
nounced
those not
school last
to attend
COPENHAGEN, Aug. 6 (INS), in the earth's solar system on port to the
A leading Soviet astronoraer which man could live similar,
expressed belief today that life to his life on earth. Ogorodni-
can exist on "numerous plan-kov expressed doubt, but added: DOOD
ets outside the earth's solar sys "Man at that time may have
tem.
many devices to enable him to
Prof Kyrill Fedorovich Ogo- eke out an existence on some o
rodnikov however, doubted planet or other
that life similar to that on earth Asked if a planet allowing
would be found on any of the life similar to that on earth
planets within the earth's solar might he found in solar systems
ystem
outside the earth's galaxy, he
Scientist hope to land space replied "Certainly there must
hips on these planets in the he numerous planets of that
next few decades but Ogorodni- kind
Reaching in
kov said his compatriots were
demand enormous speeds-
not even theoretically envision speeds up to the selocity of
ing the day they will explore light or may be beyond he
the outer galaxy
added
however
To reach these unknown At present we cannot envis
world, he said a space vehicle-age surpassing the speed of
would have to travel at the light either theoretically or log-
speed of light-about 186 300 ically, but who knows what
miles a second And it is in this kind of new relativities the fu-
outer realm of the galaxy that ture may hold for us
Ogorodnikov said there must
be numerous planets" that
could be inhabited by men
While the profesor is doing Billy Graham
his bit to help man reach the

moon and beyond, he has no
intention of going there him-
self
Ogorodnikov said he cer-
tainly would shy on earth
Preaches Today
Evangelist Billy Graham will
preach at the 9 and 11 a m.
even if the problems of space services today at the National
Presbyterian Church, N st and
flight were solved
The English-speaking seien. Connecticut ave
Doors will open at 8 am
tist who has studied at Harvard.
members
Yerkes Observa and church
with
University's
tory, is currently a professor at identification and guests with
Leningrad University. He is in invitation cards will be ad-
to 830 a
All
Denmark for the International muited up
TV
Astronautical Federation Con- others will be admitted after
Church members with
8:30
The 55-year-old Russian was identification will be admitted
asked in an interview about the up to 16 45 a m beofre the 11
CIVICE
gress.
It is impossible to say now possibilities of finding a planet a m
Inside just how much an resistance is the earth at that height takes
its metal skatt it harbors a large left at a certain height. We 90 minutes, one could also ask whether the naked eye would
for example, that no would it last for 150 hours, or be able to judge distance vari
Fances from its original orbital
One of them will count the
number of co-me rays which satellite could he established at 4500 hours, or 9000 hours
This is what has to be found path
Some scientists have even
remain at a height where it can suggested an un instrumented
a large plastic
but the satellite Another will a height of 100 miles There still
metcontes say with a diameter
count the number of particles is a trace of air up there to slow out The time the satellite with
of cosmic dust stetking it, larger it down We are also sure that not stay permanently, the rate Satellite just
at a height of 1100 miles the of slowing down and its precise 10am bubble, for this research
of our rigth of an inch or biz satellite would not be slowed behavior under these condi Dury pose But if you shoot into
down at all But what about. tions are of such importance to space you might as well shoot

that the experiment instruments and find out a few
would be worthwhile if nothing other things too
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be a fantaste concidence
Still another instrument will say, 200 miles
measure to what extent the Problems at 200 Miles
metal kin is heated by the rays
of the so Important to
know, just as it is important to
science
else were established.
Besides, the top stage of the
rocket will provide an un-instru-
mented satellite anyway Re
It has been suggested to put Would Resemble Star
A dawn or dusk, under un member that one shot produces
the first salehte at 20 miles. In
all probability it would be
know how quickly the skin will slowed down after a while sink cloudy conditions, one wille two satellites,
if the instrument
cool off when the satellite into den er layers of the atmos a pinpoint of light moving d load is separated
from the car.
phere nd burn up. But would it rectly overhead The satelite tying rocket after it gets into
One instrument will measure last for 300 revolutions, or for will resemble the ordinary star space
lers the earth shadow
(except that its light will be
Since every revolution around reflection of the sun)
the strength of the earth's mag 3000 or for 6000
netic held til of them will be
hooked up with an automatic
radio transmiter which road
call the readings to the
ground, where 1-tions can re-
ceive it and translate the radio
Invouises
with
figures
Monday. What good are satel
lites?
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fou of the artificial satellite
In external shape it may be a
sphere, or it may simply he the f
rate of slowing down to the point where it
reaches earth.
Dinn up octore it
nose cone of the rocket inside just how much air resistance is the earth at that height takes
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of cosmic dust striking it: larger it down. We are also sure that not stay permanently, the rate satellite,
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science
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hooked up with an automatic
Since every revolution around reflection of the sun)
radio transmitter which broad-
casts the readings to the
ground, where stations can re-
ceive it and translate the radio,
Impulses into figures with
meaning
This technique-the tech-
nical term is "telemetering"-
has been developed for use in
high altitude rocket shots. The
power for the transmitter will
come from the sun; the Bell
Laboratories invented their
solar battery just in time.
Location of Stations
If the artificial satellite tray-
elled along the Great Circle.
called equator it would be nec;
essary to build the receiving
stations near th cequator. Of
course they could be Navy ves
sels or airplanes converted for
this purpose. And it would fall
short in its poh in being able
to transmit only information
about conditions over the equa-
lor.
But the magnetic field of the
earth, as every body knows, dif-
fers with distance from the
magnetic pole which is not ton
far form the real pole. And.
which is not well known, the

number of cosmic rays also
varies with distance from the
magnetic pole.
In short, an artificial satellite!
traveling over the equator
would teach us less than one
which travelled along a merid.
ian from pole to pole. It may ho
pul into such an orbil, called
"circum-polar orbit," or it
may be an orzit which reaches
its highest north" over the
Arctic Circle and its farthest
south over the Antarctic Circle.
Figures to Be Exact
It must not be imagined that
The findings of the artificial
satellite will be great surprises
to scientists. One might even
Bay Jaradoxically that a sur-
prise finding would be a great
Surprise
10
When it comes
things like the number of cos-
mic rays at the distance of the
catellite, the scientist knows,
approximately what to expect.
But this is the point-he knows,
The
It only approximately.
satellite is to provide precise
figures.
One might say that the sci-
entist is in about the position of
a man who knows that a certain
store is on Fifier ave, hetween
42d and 524 sts, but does not
know the precise address. The
satellite's Instruments have to
establish the correct figures
One of them is the problem of
COOL
lites?
COOL...COOL
8:30
Astronautical Federation Con- others will be admitted after
greas.
Church members with
The 55-year-old Russian was identification will be admitted
asked in an interview about the up to 10:45 a m. beofre the 11
possibilities of finding a planet a m. service,

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THE WASHINGTON POST and TIMES HERALD
Tuesday, August 9, 19.3
Islands Import Water
First Step Into Space Hardest are, bar

(Last of a Series)
Past and Future
By Willy Ley
Some sciences began with a more or less accidental discoy- ery and progressed from there. The original discovery was tested and checked, additional discoveries were made and when enough evidence had ac cumulated a theory to explain the observed facts was con- structed.
Rocket research progressed from the other end In this case theory came first. During the last year of the first World War the American physicist. Prof Robert H. Goddard, wrote a memorandum on rocket the ory which was published in 1820 by the Smithsonian Insti tution.
Jack Raymond-
Three satellites placed around the earth in the same orbit-cach linked with the other and with the ground-can be used as TV and shortwave radio relax stations.
Wor
DAV
CHARLOTTE AMALIE. Vir areas do! the mountain slopes The 00- gin Islands, Aug. 8 -The to drain rain into cisterns. milice o United States Navy is in the Gov. Archie A. Alexander Churche water business here. has anounced a million-dollar its next
It hauls water in from Puerto program. to he financed by the Hungar Rico at $4 a ton. During a one-island, to relieve the water month period this summer the shortage Ile has not outlined Navy's barges delivered 11 mil it in detail other than to say lion gallons-more than $175, 000 worth it would include more storage tanks for rainwater and some
For years the small island of method of distillation of sea St. Thomas has faced a water water shortage. All efforts to obtain Rainfall in recent years has water by deep well drilling been helow normal and the have failed number of water using tourists
Big triangle-shaped cement has been increasing.

Advertisement
They Hear Through Their Spectacles!
At the same time, the Ger
man mathematician, Prof. Her
mann Oberth, wrote another
The amazing and marvelou use. This revolutionary devel-
Otarion Listeners for men and opment introduced by Olarion
treatise on rocket theory. It
women that have become the Research Laboratoric hearing
was not only far more techni
talk of the country are in real and exclusively for
many
cal than Goddard's but also
astransi for hearing aid of year) completely banishes a
a tonishin: Mawer with all receiver o. button in the car,!
embraced a much larger scope
clothing run cord of any kind,
Goddard had gone as far as
to investigate the possibility of artificial satellite in 1928 That will be a structure of many the difference in
speed namely flames with featherweight.com and many other former annoy
fort They are adjustable to ance: On and aff in second."
a rocket shot to the moon, un- idea is only about 10 years old job I would be an obscule per econd its
ter mild and criou hearing In e no fussing with hair and cloth.)
manned of course, while Oberth and originated during the sec tory from which astronomers esting but
true and of cout with almost unbelievable nat mg Full information and fit
took in the whole field of space and World War.
can catch the ky uniampered it soutads meredible that it ural clarity and understanding og available
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Watch Cloud Patterns
ground to the space station gives up to 120 hours of actual planne ST 21110 ST 3-5553%
10ml drove than it doc to
travel. His book was published
for the first time in Munich in 24 Hours to Circle Globe
1923 and readers who had, One of the first suggestion
enough staying power to wade made with regard to unmanned It would be a place from
through the dense underbrush
satellites was to use them a which meteorologist watch ir
of Oberth's equations could
find a theory of the artificial relay stations for short wave cloud pattern forming on the
satellite on almost the last page radio and telection you put earth below to forecast weathe
of the bonk
Basis of Modern Research
ar
aration to the
Fine tawon actually will he
an artificial satellite in an oroit on a global scale and ply
over the equator 22000 miles week as advance It enght be aspect from neindy of the
All modern rocket research from the ground it wil need 24 molitan observation p

is based ultimately on these hours to go around the carti
two works. By 1928 a kind of once
program' had been formulat
Since the earth farms at the
ed which said that after a num
ber of purely experimental aime rate the aelite would
rockets there would be rockets seem to be suspended
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Then there would he rocket around the earth in the same
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altitudes with people, or au
least a pilot aboard
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pilated rockets would ultimate point where this actually can picked because the bolt can for waale wat)
ly go into space and would he be done Whiter & into space will be the
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